MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 25—October 1839.

I.—*A Catalogue of the Species of Mammalia found in the Southern Mahratta Country; with their Synonymes in the Native Languages in use there.—By* Walter Elliot, Esq.

(*Concluded from No.* 24, *page* 103.)

Mus.

The different Indian species of this family have hitherto been classed under three groups, *Mus—Arvicola—Gerbillus.*

The species described are—

Mus Giganteus............Hardwicke.
—— *Decumanus*............Pallas.
—— *Rattus*.................Lin.
—— *Platythrix*..............Sykes.
—— *Oleraceus*........... .Sykes.
—— *Musculus*..............Lin.
Arvicola Indica..............Gray and Hardwicke.
Gerbillus Indicus.............Hardwicke.

None of these, however, except the species common to Europe, seem to have received more than a general description of their outward form, and accordingly, on looking closer into the details of their structure, and particularly to the character of their teeth, a different disposition seems necessary. Of *Arvicola* there is no example; the species characterised by Gray having molars with flat coronals, and strong radicles, in this respect assimilating with the sub-genus *Neotoma*, established by Messrs. Say and Ord in the Philadelphia Journal.

The *Mus Giganteus* of Hardwicke exhibits similar characters, but they both differ from the Florida rat, the type of *Neotoma* (as figured), in having the naked scaly tail of the common rat, whereas in the Florida species it is covered with hair.

The *Gerbillus Indicus* of Hardwicke unites both these characters, the surface of the molars being the same as that of the two Indian species indicated above, while the tail has the same peculiarity as the Florida rat, with the addition of a tuft at the extremity. But it is separated from the latter by the length of the hind foot, and the disposition of the toes, and by the carinated upper incisors; characters peculiar to *Gerbillus*. These common points of resemblance, however, show how intimately the different groups are connected, and how gradually they pass into each other. The remaining species all belong to the group of *Mus* proper, with tuberculated cheek teeth.

Of the other species, not included, that have been indicated by authors, no examples have been observed. These are *Mus Indicus* of Geoffrey, Cat. Mus. Par. Desm. VI. 299, which may perhaps be identified with Gray's *Arvicola*. The *Mus Striatus* of Seba,* adopted by Linnæus, Shaw,† and the French Naturalists,‡ has never been observed; neither has the spiny rat of Pondicherry (M. Perchal).

The species observed in the Southern Mahratta Country were—

With flat molars:

a. scaly tails—short metatarsi (*Neotoma*).

Mus Giganteus.

Arvicola Indica.

b. with hairy tail—long metatarsi (*Gerbillus*).

Gerbillus Indicus.

With tuberculated molars:

a. Covered with soft hair (*Mus*).

Mus Decumanus..................Lin.
Rattus..................Lin.
Mettade..................New sp.
Golundee..................New sp.
Oleraceus..................Sykes.
Rufus..................New sp.
Musculus..................Lin.

b. Covered with hair and spines.

Platythrix..................Sykes.
Boodaga..................New sp.

* Thes. II. 22. † Zool. VI. t. 133. ‡ Ency. Meth. t. 68. f. 6.

The first division have 3 molars in each jaw, with strong alveolar processes; the anterior or largest one divided into three sections by transverse ridges of enamel; the middle into two, and the third partly, or entirely so, as the centre ridge of enamel extends altogether, or only partly across the surface. In *Giganteus* and *Gerbillus* the enamel of the posterior molar of the upper jaw generally forms only a deep indentation. In *Gerbillus* the incisors are more prismatic, the upper ones divided by a longitudinal furrow passing down the centre. In the other two species the incisors are smooth, rounded, with a longitudinal mark on the worn under surface. The upper incisors in *Gerbillus* also are much more curved downwards than in the other two. In the former the nasal and superior maxillary bones project considerably beyond the incisors; in the latter the incisors extend beyond these bones.

30.—*Mus (Neotoma) Giganteus*, Hard. Lin. Trans.—*Mus Malabaricus*, Pennant, Quad.

Heggin,........Canarese....................ಹೆಗ್ಗಿಣ

Pandi koku.....Tel. of the Wuddur caste....పందికొక్కు.

Ghons ....Dekhuni..................گھونس

The English name, bandicoot, is a corruption of *pandi-koku*, literally pig-rat.

Lives in granaries and stack-yards; feeds entirely on grain. Fierce, bold. Makes a peculiar grunting noise when frightened or angry.

Female with 12 teats. Incisors dark olive green at the base; becoming yellow at the extremities.

31.—*Mus (Neotoma) Providens*.—*Mus Indicus*, Geoff.—*Arvicola Indica*, Gray.

Kok........Canarese.....................ಕೊಕ್ಕು

It seems necessary to distinguish this species by a new name, that of *Indicus* being too general and indefinite. Geoffroy's animal is not sufficiently particularized to indicate which of the Indian species he meant; and Gray's was given under the supposition that it applied to an *Arvicola*, which he subsequently discovered it did not: Journal Zool. Soc. July 28, 1835, p. 108. The present term seems sufficiently applicable to its habit of laying up a large store of grain for its winter food.

The *koku* is from 13 to 14 inches in length, and weighs upwards of 6 oz. Its figure is thick and strong, with powerful limbs, the head short and truncated, the ears small, sub-ovate or nearly round, and covered with a fine down or small hairs. The tail naked and nearly as

long as the body, whiskers long and full. Fur long and somewhat harsh, brown mixed with fawn, the short fur softer and dusky. The colour generally being something like that of the brown rat, with more fawn or red intermixed, and lighter beneath.

In its habits it is solitary, fierce, living secluded in spacious burrows, in which it stores up large quantities of grain during the harvest, and when that is consumed lives upon the *huryalee* grass and other roots.

The female produces from 8 to 10 at a birth, which she sends out of her burrow as soon as able to provide for themselves. When irritated, it utters a low grunting cry, like the bandicoot. Incisors entirely of an orange yellow colour.

The dimensions of an old male were as follows :—length of body 7 inches; of tail $6\frac{1}{2}$; total $13\frac{1}{2}$: of head $1\frac{8}{10}$; of ear $\frac{9}{10}$ths; of fore palm $\frac{4}{10}$ths; of hind $1\frac{4}{10}$ths. Weight 6 oz. 5 drs.

The race of people known by the name of *Wuddurs*, or tank-diggers, capture this animal in great numbers as an article of food; and during the harvest, they plunder their earths of the grain stored up for their winter consumption, which, in favourable localities, they find in such quantities, as to subsist almost entirely upon it, during that season of the year. A single burrow will sometimes yield as much as half a seer (about a ℔) of grain, containing even whole ears of *jowaree* (*Holcus sorghum*). The *Kok* abound in the richly cultivated black plains or cotton ground, but the heavy rains often inundate their earths, destroy their stores and force them to seek a new habitation. I dug up a winter burrow in August 1833, situated near the old one, which was deserted from this cause. The animal had left the level ground, and constructed its new habitation in the sloping bank of an old well. The entrance was covered with a mound of earth like a mole-hill, on removing which, the main shaft of the burrow was followed along the side of the grassy bank, at a depth of about 1 or $1\frac{1}{2}$ foot. From this, a descending branch went still deeper to a small round chamber, lined with roots and just large enough to contain the animal. From the chamber a small gallery ran quite round it, terminating on either side in the main shaft at the entrance of the chamber; and the passage then continued down to the bottom of the bank, and opened into the plain. Near the upper entrance, and above the passage to the chamber, was another small branch, which terminated suddenly, and contained excrement. But these burrows are by no means on a uniform plan. Another occupied by an adult female was likewise examined in the same neighbourhood. It was much more extensive, and covered a space of about 15 feet in length by about 8 in breadth, also in a grassy mound, of which it occupied both sides. Six entrances

were observed, (and there may have been more,) each covered with loose earth. The deepest part of the burrow near the chamber was about three feet from the surface; the chamber raised a little above the shaft, which terminated abruptly and was continued from the upper part of the chamber. The chamber itself was lined with roots of grass and bark of the date-tree. The branching galleries, of which there were six, from the principal shaft, appeared to have been excavated in search of food.

A variety found in the red soil is much redder in colour than the common *Koku* of the black land.

Another variety is said to frequent the banks of nullahs and to take the water when pursued, but the specimens I have seen differed in no respect from the common kind (of which they appeared to be young individuals), except in size.

32.—*Mus (Gerbillus) Indicus*, Hardw.

Billa Ilei....Canarese.		బిల్లియిలి
Yeri yelka / *Tel yelka*	of Wuddurs.	ఎఱ్ఱయెలుక తెల్లయెలుక.

This species has already been fully described, and some peculiarities in its cranium have been noticed above. The muzzle appears to be more pointed than stated by General Hardwicke, who characterizes it as "very round," and the colour is always of uniform bright fawn, without any admixture of brown spots, which have never been observed. The incisors are always of a deep yellow colour; the eyes very large and full, the tail longer than the body.

A large adult male measured:—length of body 7 inches; of tail $8\frac{1}{10}$; of head $2\frac{1}{10}$; of ear $\frac{9}{10}$; of fore foot $\frac{5}{10}$; of hind foot 2. Weight $6\frac{3}{4}$ oz.

They are said to be very prolific, bringing from 16 to 20 at a birth but this seems an exaggeration, and the litter probably seldom exceeds 12. It is the common prey of foxes, owls, snakes. Lives in numerous societies, making extensive burrows in the red gravelly soil of the Mulnaad, generally in or near the root of shrubs or bushes. The entrances, which are numerous, are small, from which the passage descends with a rapid slope for 2 or 3 feet, then runs along horizontally, and sends off branches in different directions. These galleries generally terminate in chambers from $\frac{1}{2}$ a foot to a foot in width, containing a bed of dried grass. Sometimes one chamber communicates with another, furnished in like manner, whilst others appear to be deserted and the entrances closed with clay. The centre chamber in one burrow was very large,

which the *Wuddurs* attributed to its being the common apartment, and said that the females occupied the smaller ones with their young. They do not hoard their food, but issue from their burrows every evening, and run and hop about, sitting on their hind legs to look round, making astonishing leaps; and, on the slightest alarm, flying into their holes.

The Wuddurs eat this species also.

33.—*Mus Décumanus*, Lin.

Manei ilei......Canarese. ಮನೆಯಿಲಿ

Chooha, and *Ghur ka chooha.* } Dekhani. چوہا گھر کا چوہا

Not so common above the Ghats as below.

34.—*Mus Rattus*, Lin.

Rare.

35.—*Mus lanuginosus.*—New species.

Mettade... ......of the Wuddurs........ మెట్టాది.

Kera ilei,..... ....Canarese.............. ಕೆರೆಯಿಲಿ

The name adopted to designate the species is taken from the word *mettade*, meaning soft, in allusion to its fur, which is fine and soft—*mettani* meaning soft in Telugu. It is also called *mettan-yelka*, *mettan-ganda*, from the same cause. It is about half the size of the *kok*, which it somewhat resembles. The head is short, but the muzzle, instead of being square and truncated, is sharp; the ears are larger in proportion and more ovate. The general form is not so stout. The tail is shorter than the body. The colour above is reddish brown, with a mixture of fawn; lighter beneath, close and soft, with a few longer hairs projecting.

A large adult male measured:—length of body, $5\frac{6}{10}$th inches; of tail, $4\frac{3}{10}$ths; total $9\frac{9}{10}$ths; of head $1\frac{4}{10}$th; of ear $0\frac{8}{10}$th. Weight $2\frac{1}{2}$ oz.

The *mettade* lives entirely in cultivated fields, in pairs, or small societies of five or six, making a very slight and rude hole in the root of a bush, or merely harbouring among the heaps of stones thrown together in the fields, in the deserted burrow of the *kok*, or contenting itself with the deep cracks and fissures formed in the black soil during the hot months. Great numbers perish annually, when these collapse and fill up at the commencement of the rains. The monsoon of 1826 having been deficient in the usual fall of rain at the commencement of the season, the *mettades* bred in such numbers as to become a perfect plague. They ate up the seed as soon as sown, and continued their ravages when the grain approached to maturity, climbing up the stalks of *jowaree*, and

cutting off the ear to devour the grain with greater facility. I saw many whole fields completely devastated, so much so, as to prevent the farmers from paying their rents. The ryots employed the *Wuddurs* to destroy them, who killed them by thousands, receiving a measure of grain for so many dozens, without perceptibly diminishing their numbers.

Their flesh is eaten by the Tank-diggers. The female produces from 6 to 8 at a birth.

36.—*Mus Hirsutus.*—New species.

Gulandi	Canarese	గుళ్లంధి
or	of	
Gulat yelka	the Wuddurs....	గులతయెలుక.

The *Gulandi* is about the size of the last species, or a little larger—but differs from it in living entirely above ground, in a habitation constructed of grass and leaves, generally in the root of a bush at no great height from the ground, often indeed touching the surface. The head is longer than that of the *Mettade*, but the muzzle is blunt, rounded, and more obtuse, and covered with rough hair. The face and cheeks are also rougher than those of the other rats; the ears round and villose; the eyes moderate; the whiskers long and very fine. The tail naked and scaly, somewhat villose. The colour is an olive-brown above, mixed with fulvous; beneath yellowish tawny; sometimes paler, or light yellowish grey.

A male *Gulandi* measured :—length of body, $6\frac{2}{10}$th; of tail, $4\frac{3}{10}$th; total $10\frac{5}{10}$th: of head, $1\frac{1}{10}$th; of ear, $0\frac{6}{10}$th. Weight nearly 3 oz.

The *Gulandi* lives entirely in the jungle, choosing its habitation in a thick bush, among the thorny branches of which, or on the ground, it constructs a nest of elastic stalks and fibres of dry grass, thickly interwoven. The nest is of a round or oblong shape, from 6 to 9 inches in diameter, within which is a chamber about 3 or 4 inches in diameter, in which it rolls itself up. Round and through the bush are sometimes observed small beaten pathways, along which the little animal seems habitually to pass. Its motion is somewhat slow, and it does not appear to have the same power of leaping or springing, by which the rats in general avoid danger. Its food seems to be vegetable, the only contents of the stomach that were observed being the roots of the *huryalee* grass. Its habits are solitary (except when the female is bringing up her young), and diurnal, feeding during the mornings and evenings.

37.—*Mus Oleraceus*, Sykes.

Meinalka, or *Meina yelka* } Canarese of the Wuddurs .... మెనెలుక.

Marad ilei,.....Canarese .... ಮರದಿಲಿ

This species has, by mistake, been designated as *M. Longicaudatus* in the distribution list at page 94, a term applied to it in my notes, some years ago, when I believed it to be undescribed, as in fact it was at the time, but it was subsequently noticed by Mr. Bennet from a specimen taken home by Colonel Sykes.*

Its colour is a bright chesnut above, beneath pure white. Head moderate, muzzle somewhat obtuse, ears ovate, tail naked.

The dimensions of a young female were:—length of body, 3 inches; of tail, $4\frac{2}{10}$ths; total $7\frac{2}{10}$ths; of head, 1; of ear, $0\frac{5}{10}$ths.

The *Meinalka* is extremely active and agile, and difficult to catch. I never procured its nest, but was told by the Wuddurs it lived always in bushes or trees, up which it is able to run with great facility. Colonel Sykes merely observes that "it constructs its nest of leaves of oleraceous herbs, in the fields." Whence the designation he has adopted for it.

38.—*Mus Flavescens.*—New species.

This species somewhat resembles the last, but is nearly double the size, is of a paler yellow colour, and was met with only in out-houses and stables at Dharwar, but there in considerable numbers. Habits social. It has been designated as *Mus Rufus* in the list at page 94; but besides that this term has been appropriated to other species, it does not express the particular colour so well as that now adopted. This is a pale yellowish brown above, and white beneath. The head is long, the muzzle pointed, the ears very large, sub ovate.

Dimensions of an adult male:—length of body $5\frac{1}{2}$ inches; of tail $6\frac{1}{2}$; total 12. Weight $2\frac{1}{4}$ oz.

39.—*Mus Musculus*, Lin.

Manei Buduga, Canarese .... ಮನೆಬುಡಗ

This I always considered to be the common mouse, but Mr. Gray considered a specimen given to the British Museum to differ from the European species.

* Proceedings, Zool. Soc. July 26, 1832.—P. 121.

Spiny Rats.

40.—*Mus Platythrix*, Sykes.

Leggyade }	of Wuddurs.......	లెగ్గాడి-
Ral yelka }		రాళ్లయెలుక్.
Kul ilei	Canarese..........	కల్లిలి

The *leggyade* has also been described by Mr. Bennet from Colonel Sykes' specimen.* I had proposed to call it *M. Saxicola* as better expressive of its habits, and as being exactly equivalent to its native name; *platythrix* expressing a generic rather than a specific character. It has the head long, the muzzle pointed, the ears rather large, oblong, rounded. Incisors yellow. Colour light brown, mixed with fawn; beneath pure white; the white separated from the brown by well defined pale fawn line. The flattened spines are transparent on the back, beneath smaller, and forming with the fur a thick close covering.

The dimensions of an

	Adult Male.	do. Female.
Length of body......	$3\frac{4}{10}$ inch	3 inches
—— of tail.......	$2\frac{5}{10}$	$2\frac{4}{10}$
Total	$5\frac{9}{10}$	$5\frac{4}{10}$ or nearly $5\frac{1}{2}$
—— of head.......	$1\frac{4}{10}$	$1\frac{3}{10}$
—— of ear........	$\frac{5}{10}$	„
—— of fore palm ...	„	„ $\frac{4}{10}$
—— of hind palm...	„	„ $\frac{7}{10}$
Weight	1 oz.	15 drs.

The *leggyade* lives entirely in the red gravelly soil, in a burrow of moderate depth, generally in the side of a bank. When the animal is inside the entrance is closed with small pebbles, a quantity of which are collected outside; by which its retreat may always be known. The burrow leads to a chamber, in which is also collected a bed of small pebbles, on which it sits, the thick close hair of the belly protecting it from the cold and asperity of such a seat. Its food appears to be vegetable. In its habits it is monogamous and nocturnal.

In one earth which I opened, and which did not seem to have been originally constructed by the animal, but to have been excavated by ants, I found two pairs; one of which were adults, the other young ones

* Proceedings Zool. Soc. 26th June 1832. p. 121.

about three parts grown. The mouth of the earth was very large, and completely blocked up with small stones; the passage gradually widened into a large cavity, from the roof of which some other passages appeared to proceed, but there was only one communication with the surface, viz. the entrance. The old pair were seated on a bed of pebbles, near which, on a higher level, was another collection of stones, probably intended for a drier retreat. The young ones were in one of the passages likewise furnished with a heap of small stones.

41.—*Mus Lepidus.*—New species.

Buduga, Canarese........ಬುಡುಗ

Chitta burkani, }
Chit yelka, } Tel. of Wuddurs. చిత్తబురకాని- చిట్టెలుక- చిట్టగంధ.
Chitta ganda, }

This pretty little species resembles the preceding, but is only about one third of the size. The colour is similar, but paler, and it has the same pure white under surface, separated from the upper by an exact line. The spines are small, fine, transparent, and of a dusky tinge, tipt with fawn. The head is very long, being nearly one third the length of the body, and the muzzle pointed. The ears are large, ovate, naked. Incisors white. Tail naked, scaly. Limbs rather long, fine; the 3 middle digits of the hind foot produced, as in *Gerbillus*, the two outer ones much shorter and nearly equal.

The dimensions of an old male were—length of body $2\frac{9}{10}$th inch; of tail, $2\frac{7}{10}$th; total $5\frac{6}{10}$th; of head $\frac{9}{10}$th; of ear $4\frac{1}{2}$-10th; of fore palm $2\frac{1}{2}$-10th; of hind palm $\frac{6}{10}$th; weight 6 drs., but in general it does not exceed a $\frac{1}{4}$ of an oz. (or 4 drs.).

Lives generally in pairs in the red soil, but sometimes a pair of young ones is found in the same burrow with the old ones. Does not produce more than 4 or 5 at a birth.

42.—*Sciurus Palmarum*, Gmel.—*Rat Palmiste,* Brisson.

a. common variety.

b. darker coloured, peculiar to the Ghats.

Alalu................Canarese..........ಅಳಲು

Gilheri...............Dekhani.......... گلهيري

Urta..................of the Wuddurs....ఉడత.

The common species is sufficiently well known; the other, found only in the forests of the Ghats, is darker, the front and the back between the stripes reddish brown, the stripes small, narrower than in the common kind, and not extending the whole length of the back.

The size of both is the same.—Length, 13 to 14 inches; weight of males, 4 oz. 12 drs; females 4 oz. 11 drs-

The young are born without any hair, but three dark lines are visible along the back indicating the position of the future stripes.

43.—*Sciurus Maximus*, Gmel.—*S. Elphinstonii*, Sykes.

Shekra,..............Mahratta ... } of the Ghats.. }

Kes Annalu.........Canarese...... } of the Halapyks. } ಕೆಅನಲು

I have observed the same uniformity of colour in the Ghat variety that has been described by Colonel Sykes; but it seems doubtful whether mere difference in colour, constitutes sufficient grounds for the formation of a new species. I have had both the black and the red kinds alive, and tame, in my possession, for months together, and I observed the most perfect similarity in their habits, cry, and in every particular except in that of colour.

Though I never met with individuals of the *S. Maximus* in the forest, I have often obtained them from the people of the country, who said they caught them in the Southern parts of the mountain range. The same disposition to vary in the shade and distribution of colour has been remarked by Dr. Horsfield in the Java congener of the Indian species, the *Jeralang*, or Leschenaults squirrel, a specimen of which has been described by Geoffroy as *S. Albiceps* from a casual difference of this kind. These varieties probably depend on locality, and have given rise to a great multiplication of species. Thus we have the *S. Macrurus* of Gmel., identified by Cuvier with *S. Maximus*: *S. Ceylonensis* of Ray; *S. Indicus* said to come from Bombay, &c. Fischer makes the distinction between *S. Maximus*, and *Macrurus* to consist in the former having the cheek stripe terminating simply, while in the latter it is forked. J. B. Fisch. Syn. p. 363.

44.—*Pteromys Philippensis ?*—New species ?

Pukhya........... } Mahratta...... }
or
Pakya............ } of the Ghats..... }

Mr. Gray designated the specimens of this species presented to the British Museum by the specific name of *Philippensis*, and showed a for-

mer description of them under this title, the source of which I have mislaid. I cannot however find any such species indicated in Griffith's Synopsis, in Fischer's Mammalia, nor in any work to which I have access.

The length of the male is 20 inches, and the tail 21 = 41 inches: that of the female 19, and the tail 20 = 39 inches.

The colour above is a beautiful grey, caused by the intermixture of black with white and dusky hairs; beneath it is white, the legs and posterior half of the tail black. The male is distinguished by an irregular patch of rufous on the sides of the neck, which in the female is a sort of pale fawn. It is very gentle, timid, and may be tamed; but from its delicacy is difficult to preserve. Lives in the holes of trees in the thickest part of the forest.

45.—*Hystrix Leucurus*, Sykes.

Yed Cánarese .... ಯೆದ
Sirsel } Dekhani .... سرسل
Sayal } Dekhani .... سايل
Sahi ? } Dekhani .... ساهي
Salendra Mahratta of the Ghats.
Saori or *Chaodi* of Guzerat

46.—*Lepus Nigricollis*, Fr. Cuv.

Malla, Canarese ....ಮೊಲ
Sassa, Mahratta ....
Khargosh, Dekhani .... خرگوش

47.—*Manis Crassicaudata*, Griffiths—*M. Pentadactyla*, Lin.—*Pangolin à Queu Courte*, Cuv.—*Broad-tailed Manis*, Pen.

Kowli Mah, Mahratta of the Ghats...
T'hiriya do. ....
Alavi, *Alawa*, } of the Wuddurs ....ಅಲವಿ
Shallama *Shalma* } of the Baüris.. ....

The manis burrows in the ground, in a slanting direction, to a depth of from 8 to 12 feet from the surface, at the end of which is a large chamber, about 6 feet in circumference, in which they live in pairs, and where they may be found with one or two young ones about the months of January, February, and March. They close up the entrance of the

burrow with earth, when in it, so that it would be difficult to find them; but for the peculiar track they leave.

A female that I kept alive for some time, slept during the day, but was restless all night. It would not eat the termites or white ants put into its box, nor even the large black ant (*Myrmex indefessa*, Sykes) though its excrement at first was full of them. But it would lap the water that was offered to it, and also conjee or rice water, by rapidly darting out its long extensive tongue, which it repeated so quickly as to fill the water with froth.

When it first came it made a sort of hissing noise, if disturbed, and rolled itself up, the head between the four legs, and the tail round the whole. The claws of the forefeet are very strong, and in walking are bent under, so that the upper surface is brought in contact with the ground; its gait is slow, and the back is curved upwards.

After its death a single young one was found in it (Sept. 15th), perfectly formed, and about 2 inches long. The marks of the future striated scales were distinctly visible, and its long tongue was hanging out. The tongue of the old one was 12 inches in length, narrow, flat, fleshy to the tip, the muscle along the lower surface very strong.

The length of the animal was 40 inches. The weight 21-lbs.

48.—*Elephas Indicus*, Cuv. *Mem. de l'Inst.*

Anei, Canarese............ಆನೆ

Hathi, Dekhani............هاتهي

The elephant is rare above the ghats, but occasionally a stray male makes his way up, and does much mischief to the rice-fields and gardens.

49.—*Sus Scrofa*, Lin.

Handi, *Mikka*, *Jevadi*, } Canarese.... { ಹಂದಿ, ಕರಿಮಿಕ, ಜಿವಾದಿ

Bûra Janwar, *Sûr*, } Dekhani....سور برا جانور

Dûkur, Mahratta.

The Indian wild hog differs considerably from the German. The head of the former is longer and more pointed, and the plane of the forehead straight, while it is concave in the European. The ears of the former are small and pointed, in the latter larger and not so erect. The Indian is altogether a more active looking animal; the German

has a stronger heavier appearance. The same differences are perceptible in the domesticated individuals of the two countries.

50.—*Moschus Memina*, Erxleben.—*Memina*, Knox.—Ceylon p. 21.—*Pissay*, Ham. Voy. E. Ind. I. p. 261.

Berka, } Canarese... ಬರಕ
Burka, }

Pisei, } Mahratta........ }
Pisuri, } of the Ghats...... }

Common in the forest and even occasionally seen in the Mulnad.

51.—*Cervus (Rusa) Hippelaphus*, Cuv.

Kadavi............Canarese....... ಕಡವಿ

Samber.......... { Mahratta and Dekhani } سامبر

Bara Sinha...... { Erroneously of Mahomedans

Meru................Mahratta of the ghats.

There is only one species of *Rusa* found in the Western forests, which is common also to all the heavy jungles of Southern India. None of the descriptions given by Hamilton Smith to the different Indian species, under the names of *Hippelaphus*, *Aristotelis*, *Equinus*, apply exactly to it: but I have little doubt that all three are only varieties of the great Indian stag, originally described by Aristotle under the designation of *Hippelaphus*, and discriminated as such by M. Duvancel, in the Asiatic Researches, vol. xv. p. 174; to which it is not improbable the *C. Unicolor* or *Gona* of Ceylon, is also referrible.

The points of distinction that have been noticed are, the characters of the horns, size, colour, absence or presence of a disk on the buttocks, canine teeth, and minute distinctions in the proportions of the bones of the skull.

The horns of different individuals present great diversities of form. The only common characters are those of a basal antler, springing directly and equally with the beam from the burr; and the beam terminating in a bifurcated extremity, formed by a branch or snag separating posteriorly and pointing obliquely to the rear. But I have met with instances of medial antlers, of trifurcated extremities, and in one case, with the extremity showing a fourfold division, as in the annexed sketch of a *Samber* killed by Captain Green, Madras Engineers, in the Bellarungin Hills between Mysore and Coimbatore. Plate 4 fig. 1.

The size of the Southern *Rusa* is large, sometimes exceeding 14 hands in height. The colour varies from dark brown to dark greyish black or slate-black ; with the chin, the inner sides of the limbs, the under part of the tail, and the space between the buttocks, yellowish white, passing into orange yellow, but never extending into a large circular disk on the buttocks. In several instances I have met with the hinds of a pale yellow or light chesnut colour. These were young individuals, but the *shikaries* always declared them to be the same as the common kind, and no other difference was perceptible. The cranium of one of these light coloured females presents no structural differences from that of a young black female. Both sexes have canine teeth in the upper jaw, springing from the suture between the maxillary and intermaxillary bones. The neck and throat are clothed with a long mane. The suborbital sinus is very large. When the animal is excited, or angry, or frightened, it is opened very large, and can be distended at pleasure. The new horns are soft and tender during the monsoon, from June to September, about which time the rutting season commences. The stags are then fierce and bold. I have seen one, when suddenly disturbed, face the intruder for a moment, shaking his head, bristling his mane, distending the suborbital sinus and then dashing into the cover.

52.—*Cervus Axis*, Erxleben.

Sarung.... } Canarese ಸಾರಂಗ
Saraga.... } ಸಾರಗ

Chital .... { Mahratta and Dekhani چیتل

53.—*Cervus Muntjak*, Zimmermann.

Kankuri......Canarese ಕಾಕ ಕುರಿ
Jungli Bukra..Dekhani .... جنگلي بکرا

Bekra....... Mahratta

This animal does not seem to differ in any respect from the *Kijang* of the Eastern Islands.

A young male of this species was in my possession for many months, and was quite tame. It was of a deep chesnut colour, which becomes browner as the animal grows older. On the face appeared the plaits or ribs of skin between the eyes, running up to the fore-head and ending in a triangular patch of stiff hairs of a dark brown colour, at the upper side of which the horn afterwards sprouted, making its first appear-

ance in the month of August. It had white spots in front of the fetlocks of all the four legs, and a little white likewise on the chin, upper throat, inside of arm-pits and thighs, and under the tail, but none on the lower part of the throat or on the belly. It used to lick its face with its tongue, which was remarkably long and extensible, reaching back over the eyes and the whole face, and frequently uttered a short, small cry, sharper than that of a kid.

It obtains its Canarese name from its habit of frequenting the *Kans*, or natural forest gardens.

54.—*Antilope Cervicapra*, Pallas.

Chigri	Canarese.	ಚಿಗರಿ	
Mriga	Sans.	ಮೃಗ	
Hurn	Mahratta and Dekhani	هرن	The Buck.
Kalweet	Mahratta and Dekhani.	کالویت	The Buck.
Phundayat	Mahratta.		The Buck.
Hurneen	Mahratta and Dekhani.	هرني	The Doe.
Alali, of the Baöris,*	the Buck.		
Gundoli, ditto	the Doe.		

Frequents the black plains, in herds of sometimes 20 or 30 ,each, of which has only one buck of mature age, the others being young ones. The buck of the herd always drives off the others, as soon as they begin to turn black, in the course of which desperate combats ensue, by which their horns are often broken.

The horns of the male in the Southern Mahratta Country seldom exceed 19 or 20 inches. The longest I have seen of a great number of specimens is 22 inches, with 4 flexures in the spiral twist ; but I have seen a pair of horns from Hyderabad, 24 inches long,with 5 flexures and 50 rings or annuli ; and another pair from Kattewar which were 25 inches.

The rutting season commences about February, or March ; but fawns are seen of all ages, at every season. During the spring months the

* The *Baorees* or *hurn shikarees*, called also *Aravi-Chinchers*, are a singular nomade tribe, who live entirely by capturing antilope by means of springes, in which they are very successful. They also catch the Chita (*Felis Jubata*) for the *Meer Shikaries*. They wear a dress of a sort of brown coloured cloth peculiar to themselves, and speak a dialect of Hindu with a very singular intonation.

buck often separates a particular doe from the herd and will not suffer her to join it again, cutting her off and intercepting every attempt to mingle with the rest. The two are often found alone also but on being followed always rejoin the herd.

When a herd is met with, the does bound away for a short distance and then turn round to take a look—the buck follows more leisurely, and generally brings up the rear. Before they are much frightened they always bound or spring, and a large herd going off in this way is one of the finest sights imaginable. But when at speed the gallop is like that of any other animal.

Large herds are found about Hookerry, and thence towards the Kistna, keeping to the high rocky basaltic eminences, called by the Natives *mal.* It is remarkable that the gazelle is rare on these situations so well adapted to their habits. Some of the herds are so large, that one buck has from 50 to 60 does and the young bucks driven from these large flocks are found wandering in separate herds, sometimes containing as many as 30 individuals of different ages.

They show some ingenuity in avoiding danger. In pursuing a buck once into a field of toor, I suddenly lost sight of him and found after a long search that he had dropt down among the grain and lay concealed with his head close to the ground. Coming, on another occasion, upon a buck and doe with a young fawn, the whole party took to flight, but the fawn being very young, the old ones endeavoured to make it lie down. Finding, however, that it persisted in running after them, the buck turned round and repeatedly knocked it over in a cotton field until it lay still, when they ran off endeavouring to attract my attention. Young fawns are frequently found concealed and left quite by themselves.

55.—*Antilope Arabica,* Hemprich and Ehrenberg Fischer's Synopsis *b.* 5. p. 460.—*A. Bennettii,* Sykes.

Budari,	Canarese of southern talooks.	ಬುಡರಿ
Mudari,	Canarese of northern talooks.	ಮುಡರಿ
Tiska,	Canarese	ತಿಸ್ಕ
Chikara,	Dekhani	چکارا
Porsya,	of Baöris, the Buck.	
Chari,	ditto. Doe.	

The Indian gazelle always appeared to me to be new and undescribed, until I met with the Arabian species on the Southern and Eastern shores of Arabia in 1833; a careful examination of several individuals, both in a state of captivity, and that had been shot, convinced me that they were identical with the Indian species. And in this, I was confirmed by the opinion of M. Rüppell, formed on inspection of a stuffed skin taken home by me. They abound also in the islands of the Red Sea, particularly in Dhalak, and on the western shores about Massowa, and probably all along the Abyssinian Coast. The gazelle of the Hauran and of Syria, appeared also to be of this species; but I never had an opportunity of examining one closely. If this be the case, the *Chikara* possesses an additional interest, in being the same animal as the roe and the roe buck of Scripture. The modern name for the gazelle in Yemen is ظبي Dabi or Dzabi which is the same as the Hebrew word translated "Roe." Deut. 14, 5. It is likewise the gazelle of the Arabian poets, as appears from the common saying احور من كل الظبي "The eyes of the Dabi are the most beautiful of all."

It is found on the red sandy plains, or among stony open hills, and abounds in the basaltic formation of the Dekhun, in the valleys of the sandstone formation, and generally among the jungles of the red soil to the eastward of the Southern Mahratta Country. It is never seen on the black plains, nor among the western jungles, nor in the Mulnad.

It is found frequently in herds of three, generally a buck with two does; also of 5, 6, or 7, or more. The young expelled bucks are also found in separate herds like those of *A. cervicapra*. When two bucks fight they butt like rams, retiring a little and striking the foreheads together with great violence. When alarmed it utters a sort of hiss by blowing through the nose and stamps with the fore-foot, whence its Canarese name of *Tiska*.

The dimensions of an adult male procured at Dumbal in the Southern Mahratta Country, the skin of which is now in the British Museum, were as follows: height at the shoulder 2 feet, 2 inches; at the croup 2 feet 4½ inches; length from the nose to insertion of the tail 3feet, 5½ inches; of tail 8½ inches; of ear 6 inches; of horns 11 in.; of head 9 in. Weight 48-lbs.

But these are by no means the largest dimensions observed. At Deesa in Goozerat, where it is much more common, I measured three crania, the dimensions of the horns of which were

Length,	10½ in.	10¾ in.	11½ inches.
Distance between the points.	6½	6½	5
Number of annuli	14	16	18

including the two imperfect ones near the tip. The third or largest

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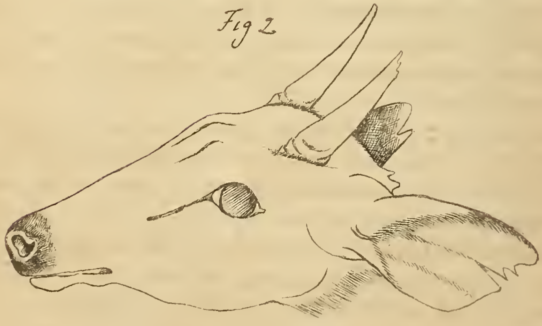
Fig. 1

Fig 2



1. Cranium of Cervus Hippelaphus.

2. Head of Antilope Sub-4-cornutus.

were very little lyrated; the 2d were the strongest and thickest. I have also killed the buck weighing 51-lbs., the does weigh from 35 to 40-lbs. This is about half the weight of *Cervicapra* which varies from 90 to 100-lbs.

The adult female has the horns inclining more to the rear, curved backwards, the tips forwards, slightly wrinkled at the base, the rest smooth and black, and nearly equidistant.

In both the lachrymatory sinus is small and black. There is a dark spot on the nose, and a line from the eyes to the mouth surmounted by a light one. Knee-brushes, tail and fetlocks behind, black; chin, breast, and buttocks behind, white. Rest of the body, dark fawn deeper where it borders the white on the sides and buttocks. Ears long, 3 ridges of hair along the inner surface.

Inguinal pores, 2 mammæ. Horns of the female sometimes with a few imperfect annuli, and never corresponding with each other.

56.—*Antilope Sub-4-Cornutus ?*—New species ?—*Antilope Chikara,* Hardwicke.—*Brown Antilope,* Sykes.

Kondguri,	Canarese.	ಕೊಂಗುರಿ
Junglibukra,	Dekhani.	جنگلي بکرا

It is not improbable that the *chikara* (a name, by the way most incorrectly applied to this species, being restricted by all natives to the preceding one), the *Quadricornis* of Blainville, and the *Striaticornis* of Leach—all refer to the same animal. But the descriptions being only from isolated individuals, have not been sufficiently discriminated to determine the point.

The detailed description of General Hardwicke in the Linnæan Transactions, differs in many important particulars from the characters of the Dekhan species. This is much larger, and the colour varies considerably both from the Hindostan *chikara,* in which it is of a "uniform bright bay," and in the shades of individuals of different ages in the Dekhan. The spurious horns are so small, as rarely to be met with in adult individuals, and are situated on two osseous bumps or risings (strongly marked in the cranium) from which they seem to be easily detached. These osseous risings are immediately in front of the true horns, between the orbits, rather in front of a line drawn across the forehead through the centre of the eyes, and become covered with black callous skin, after the loss of the corneous tips. The true horns are situated behind the eyes or between the eyes, and the ears, inclining backwards with a scarcely perceptible curve forwards, straight, parallel, round, smooth, thick, and strong at the base which has a few wrinkles

and tapering to a point, their colour black. Those of a very old male were $4\frac{3}{4}$ inches in length and had 3 strong wrinkles, and one imperfect one at the base. Plate iv. fig. 2

The dimensions of a young adult male were :

Height at the shoulder, 2 feet $1\frac{1}{2}$ inch ; croup 2 feet, 3 inches, length from the muzzle to the insertion of the tail, 3 feet, 6 inches; of tail 5 inches ; ear $4\frac{1}{4}$; horn 4 ; from the muzzle to the base of the horn, 6 ; of head 8 ; leg 1 ; foot 5 inches. Weight 43 lbs.

But I have found them even heavier. The doe is about the same size and has no horns, nor any bony projection above the eyes. The mammæ are four in number. The colour is brown, of various shades, not bright, but sometimes so light as to approach a dull fawn, darker than the *Cervicapra*, but not so bright and deep as in the gazelle. The shade is browner on the hind quarters, and darkest on the middle of the back. It becomes lighter on the sides till it passes gradually into white in the middle of the belly, without the well defined dark line of separation, observable in the other two species. The forelegs, particularly above the knee, the inside of the fetlocks, the nose and edge of the ears, are very dark. A narrow line between the fore-legs which gradually widens towards the hinder flanks, the inside of the arms and thighs, are white as is the inside of the ear, in which the hairs are long, and arranged in indistinct ridges. The lachrymatory sinus is long, narrow and parallel with the line of the nose.

In its habits, it is monogamous, and is always found in pairs, frequenting the jungles among the undulating hills of the Mulnad. It is never found in the open country, or among the hills on the eastern side of the district, neither does it ever penetrate into the western forests. The droppings are always observed in heaps in particular spots. It is said to be fond of licking the salt efflorescence of the soil, from which habit the incisors of old individuals are often found to be much worn, and sometimes wanting altogether.

57.—*Damalis Risia*, Hamilton Smith.—*Antilope picta*, Pallas.—*Neelgao*, Buffon and Shaw.

Maravi,	Canarese.	ಮರವಿ
Roj'h,	Dekhani.	روجھ
Ruhi,	Mahratta.	

It is found in the thick low jungles of the Rone and Chudi Pergunnahs, in those of Goonjeehal near the Sungam of the Kistnah and Ghatparba rivers in the Mubiluhal talook, and in the Moolwar Nala towards Beejapoor, but never in the open black plains, the Mulnad, or the Ghat

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forests. It is comparatively rare, and is becoming more so, every day. The country people are apt to confound it with the *Sambur*; but the localities frequented by the two animals are totally different. The *Sambur* is impatient of heat, and requires shade and deep cover, the *Neelgao* is indifferent to the sun, and in the open plains, at noon, it requires a good horse and a long run to come up with it. I had a tame female of each kind for a long time in the same paddock. The *Neelgao* used to drop on its knees to feed, and attacked and defended itself by butting with the head. The *Sambur* on the other hand never knelt, and when irritated, used to rise on its hind legs, and strike with the fore-feet. In Goózerat the *Neelgao* is found in the open, grassy plains; the herd marches in a line, the bull leading with 8 or 10 cows following.

58.—*Bos (Bibos) Cavifrons*, Hodgson—Journal Asiatic Society Bengal, vol. VI. (1837) pp. 223, 499, 745.

Bos Gaurus, Griffiths.—*Gour*, Geoff.

Kar kona,	Canarese..................	ಕಾಡು ಕೋಣ
Jungli khoolga,	Dekhani..................	جنگلي كهولگا
Gaviya,	Mahratta..................	

It is somewhat remarkable that one of the largest animals of the Indian Fauna, frequenting all the extensive forest tracts from Cape Comorin to the Himalayas, should only have been indicated distinctly, within the last two years. I have seen specimens from Tinnevelly, and likewise from the whole range of the Syhadree mountains up to Mahableshwar, and I know that the animal has been killed near Vellore, in the Sherwaroyah hills near Salem, at Aseergurh, in Kandes, Rajahmundry, and I doubt not that it will likewise be found in all the deeper recesses of the eastern ghauts, and on the banks of all the great rivers passing through them. An imperfect cranium which seems to belong to a female of this species, in the United Service Museum, is labelled thus "Head of a Bison from Kuddah, Straits of Malacca, presented by Lieutenant Colonel Frith, Madras Artillery."

The following memoranda were made in 1833 in the Southern Mahratta Country at a time when I had frequent opportunities of seeing the animal. "It is called *Gaviya* by the Mahrattas, *Jungli khoolga* and *Urna* by the Mahommedans (though it has not the slightest affinity with the buffalo to which both of these names apply), and *Karkona* by the Canarese, which is of similar import, from *Kadu*, a forest, and *Kona* a buffalo.

It differs also very remarkably from the common ox, and though it approaches considerably more to the descriptions of the bison, the name

generally applied to it by English sportsmen, it exhibits marked structural differences excluding it from the Bisontine group as defined by Cuvier. These consist in the plane of the fore-head being "flat and even slightly concave," and in the possession of only 13 pair of ribs. It is not improbable that it will be found to constitute a connecting link between the Bisontine and Taurine groups. The most remarkable characters in the animal are an arched coronal, or convex bony ridge, surmounting the frontal bone, and projecting beyond it so as to make the line from the vertex to the orbit a concave sweep; the continuation of which from the orbit to the muzzle is slightly convex. The other distinctive mark is the prolongation of the spinous processes of the vertebræ of the back, from the withers to the loins where they cease abruptly. These processes are 12 in number and their prolongation gives the animal a very extraordinary appearance.

The largest individual I met with, was killed in an island of the Kala Nuddee in the district of Soonda, in 1827. A noted shikaree, the Potel or head-man of Alloor (a Hubshee or negro descendant of some of the numerous African slaves imported in the 15th century by the Mahommedan kings of Beejapoor, and who still exist as a distinct race, in this district), called us at day light and promised to show us one of the animals described by him as a wild buffalo. Crossing the river in a canoe, we struck into the forest and soon came upon a track, which he pronounced to be that of a large bull. On this he proceeded with the steadiness and sagacity of a blood hound, though it was often imperceptible to our eyes. At times when a doubt caused us to stop, he made a cast round and on recovering the track summoned us to proceed by a loud whistle, or by imitating the cry of the spotted deer, for not a word was spoken, and the most perfect silence was enjoined. As we advanced he pointed silently to the broken boughs or other marks of the passage of a large animal, and occasionally thrust his foot into the recent dung, judging by its warmth of the vicinity of the game. We followed his steps for three miles to the river, then along the banks towards Dandelly, where the animal appeared to have passed to the other side. Wading across, we ascended the bank of a small island covered with thick underwood, and some large trees, amongst which it had lain down, about fifteen yards from where we stood. The jungle was so thick that we found it difficult to distinguish more than a great black mass among the underwood. On firing the animal got on his legs, received two balls more, and rushed into the jungle where he became very furious, and we were obliged to shelter ourselves behind the trees, to avoid the repeated charges he made, though one ball through the shoulder which had broken the bone above the elbow, pre-

vented his moving with facility. He then became exhausted and lay down snorting loudly and rising to charge when any one approached. A ball in the forehead caused him to roll over the precipitous bank into the river. Still however he was not dead and several balls were fired into his forehead behind his ear and the junction of the head and neck without life becoming extinct, one ball which had struck the vertebræ of the neck was taken out almost pulverized.

When drawn ashore and examined more minutely, the first sentiment produced in all present, was astonishment at his immense bulk and size; but on measuring his height we found him much taller than his breadth at first led us to imagine.

The head is very square and shorter than in the common ox, the forehead ample, the bony ridge rising about five inches in height from the plane of the frontal bone over which it inclines. When viewed behind it rises suddenly and abruptly from the nape of the neck, from whence to the vertex it measures seven inches, the horns make a wide sweep in continuation of the arched bony ridge, and turn slightly backwards and upwards forming an angle of about 35° with the frontal bone, the whole of the head in front, above the eyes, is covered with a coat of close short hair of a light greyish brown colour which below the eyes is darker approaching almost to black. The muzzle is large and full, and of a grayish colour, the eyes are smaller than in the ox, with a fuller pupil of a pale blue colour, the ears are smaller in proportion than in the ox, the tongue is very rough and covered with prickles, the neck is short thick and heavy, the chest broad, the shoulder very deep and muscular, the forelegs short, the joints very short and strong, the arm exceedingly large and muscular. Behind the neck and immediately above the shoulder rises a fleshy gibbosity or hump, the same height as the dorsal ridge, which is thinner and firmer, rising gradually as it goes backwards and terminates suddenly about the middle of the back. The hind quarters are lighter and lower than the fore, falling suddenly from the termination of the ridge, the tail very short, the tuft only reaching down to the hocks.

The dimensions of this individual were carefully noted as follows :—

	feet	Inches.
Height at the shoulder	6	1½
Do. at the rump (taken from hoof to insertion of tail).	5	5
Length from the nose to the insertion of the tail	9	6½
Do. do. to the end of the tail which was 2 ft. 10 in...	12	4½
Do. of dorsal ridge including the hump	3	4
Height of do. do.	0	4½
Girth (taken behind the forelegs)	8	0

nated with natron or soda, which seems as essential to their well-doing as common salt is to the domestic animal when kept in hilly tracts.

The chief food of the Bison seems to be the following grasses and plants,

Yadanjān cody ....

Vallaum pilloo .... *A species of Sacharum, used for thatch.*

Odeserengan pilloo ....

The cottay mootoo leaf......... *Ricinus Communis. Castor oil Plant.*

Mullum pilloo .... *Anthystiria polystachia, Roxb.*

Canavum pilloo................. *Sorghum muticum. Wild Cholum.*

Cheevum pilloo .... *Broom grass. (Aristida).*

Cattoo Corangan leaf......... *A species of Convolvulus. Ipomœa Staphylina ?*

but they will eat with avidity every species of grain commonly cultivated on the hills or plains, as the ryots find to their cost. The Bison particularly is so fond of the *avaray cottoy* (*Dolichos Lablab*, Ainslie),* when in blossom, that they will invade, and destroy fields of it, in open daylight, in despite of any resistance the villagers can offer. In other respects it is a very inoffensive animal, very rarely attacking any one it encounters, except in the case of a single bull driven from the herd. Such a one has occasionally been known to take up his location in some deep bowery jungle, and deliberately quarter himself on the cultivation of the adjacent villages. The villagers, though ready to assist Europeans in the slaughter of Bison, will not themselves destroy them (the inviolability of the cow extending to the Bison); and so bold does this freebooting animal become in consequence, that he has been known to drive the ryots from the fields, and deliberately devour the produce. But in general it is a timid animal, and it is often difficult to get within gun-shot of them.

The period of gestation is with the Bison the same as with the domesticated animal; they drop their young in the months of September and October. I once had one brought to me so young, the navel string was still unseparated. I should think it was then about the size of a common country cow's calf of four months old. It seems a slow growing animal. A calf I had for three years was evidently in every respect still a mere calf. They seem very difficult to rear. I have known it attempted at different ages, but never knew the animal to live beyond the third year. Mr. Cockburn has tried it in vain, in its native climate, the Sherwaroyah hills, and I have made the attempt at Salem repeatedly. At one time I had five in my farm-yard; one lived for three years: but this one, with all the others, died suddenly in the same week from some disease, marked by refusal of food, running from the nose, and an abomina-

* Country bean.

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Cranium of the Bos Gaurus

ble stench from the mouth. A similar disease, it may be noted, prevailed, I was informed, at the same time, among the Bison of the Sherwaroyah, Shandamungalum and Neilgherry hills. The calves I had, never became in any degree domesticated : the domesticated cow could never be induced to suckle them."

I may add, that the persevering ferocity of the Bison of the Sub-Himalayan range, described by Mr. Hodgson, is quite foreign to the character of the animal in the southern forests. When wounded, it is true, it charges its assailant with determined courage, and many instances have come to my knowledge of its doing so with fatal effect, among which I may cite those of two officers within the last few years, both of whom were killed at the Mahabaleshwar hills ; but in general it will always seek its safety by flight, if permitted.

The figure at Plate 5 is taken from an indifferent sketch made of the very old bull, described at page 229, and gives a tolerable idea of the character of such an animal, though not quite correct in all its details. The dorsal ridge is too prominent ; the expression of the head, particularly about the muzzle, is too heavy, and the hoofs of the hind feet are too large, these being in reality only half the size of those on the fore-feet.

Plate 6 shows the crania in front and profile of another very old bull, killed on the Neilgherry hills, now in my possession ; and of a young cow. The difference produced in the shape of the horns by age is distinctly shown. The great expansion of the bull's horns is entirely the effect of age, in the young males they are more erect, and the points turned to each other, while in this individual they are altogether divergent, one being half broken off, and the point of the other worn and ragged, which is always found to be the case with adult bulls. The dimensions of this cranium are—

Height from the end of the maxillary bone to the vertex...Inches.	22
Breadth of front between the edges of the horns.............	13 to 14
Length of horn from base to point in a straight line...........	21
Do. do. along the curve..........................	30
Diameter (longest section) inside...........................	$6\frac{1}{2}$
Do. (broadest do.)..	$4\frac{3}{4}$
Circumference at the base.................................	$18\frac{1}{3}$
Distance between the points..................................	39

The above catalogue being confined to the animals of a single province, does not comprise the whole number of species found in Southern India ; but, from the very diversified character of its surface, it includes by far the greatest proportion. In a future number, I propose adding a supplementary list of species peculiar to the Carnatic, and so to complete the fauna of Southern India.

II.—*Catalogue of the Birds of the Peninsula of India, arranged according to the modern system of Classification; with brief Notes on their Habits and Geographical Distribution, and description of new, doubtful and imperfectly described Species*:—*By* T. C. Jerdon, *Assistant Surgeon, 2d Madras Light Cavalry.*

(*Continued from No.* 24 *page* 91.)

Supplement to Raptores.—*By* Walter Elliot, Esq.

Since the publication of the first portion of Mr. Jerdon's Catalogue, I have been enabled to add another beautiful accipitrine bird to his list. It belongs to Genus Nisætos, Hodgson; and should follow immediately after *N. Niveus?* No. 12 in the Catalogue.

12½. *N. Cristatella,* Temm. Pl. Col. p. 282—*Shah Baz,* H.

Adult male of 1st year—Total length 24 inches; length of tail, 11$\frac{2}{10}$; of bill, straight to gape, 1 $\frac{7}{10}$; tarsus from the angle of the outer bend to the sole 4$\frac{4}{10}$ths; central digit 2; do. claw 1$\frac{1}{10}$th; hind digit 1$\frac{2}{10}$ths; do. claw 1$\frac{4}{10}$; of wing closed 16 inches; two central crest feathers, 4; two next, 2¼: colour brown; beneath, brown intermixed with white; each feather being brown with a white edge, which increases with successive moultings until the brown is reduced to a mere line. Crest dark brown, approaching to black. Quills barred transversely with darker brown. Tail with 4 well defined bands, the last forming the tip, and an imperfect one near the base making a fifth. Feathers of the tarsi with a slight fawn tinge spotted with brown.

Sits on the tops of the highest trees, on the watch for hares, pea-fowl, jungle-fowl, on which it swoops from its elevated perch. Solitary. Shot in the Rampoor jungle, inland from Nellore, at the foot of the eastern ghats.

I have now before me a living specimen of the species distinguished as *Nisætos Niveus,* and two skins of the same bird. The corresponding dimensions of an adult male of several moultings are—total length, 26 inches; length of tail 11; of bill, straight to gape, 2; tarsus, from the angle of the outer bend to the sole, 4; central digit 2$\frac{4}{10}$ths; do. claw 1$\frac{2}{10}$ ths; hind digit 1$\frac{2}{10}$ths; do. claw 1 $\frac{5}{10}$ths; wing closed 18 weight 3-lb. 13¾ drs.

The *Mhorungee* is not crested. It is stronger and altogether more powerful than the *Shah Baz.* Tarsus shorter; talons more powerful.

Beneath whiter, because older, the brown being reduced to the shafts of the feathers only. Tail with 7 bars, the last forming a broad dark band at the tip, the others narrower, indistinct, particularly those next the tip. Quills dark brown, not banded. Cere and legs, pale yellow; bill plumbeous at the base, black at the tip.

There is little doubt this is a new species. Temminck's bird is only 25 inches, and the wings have a band, and the tips of the quills brown.

In habits it differs much from the last, seeking its prey more frequently on the wing, hunting in pairs and stooping on hares, pea-fowl, &c.

The living one was caught at the rocky mountain of Awulkondah in the Arcot district, where a pair of them were used to resort, by baiting some falconer's springes with a fowl, on which they both descended. One was caught in the snares, the other alighted on a tree in the neighbourhood and was shot. The female measures 28 inches in length.

Order II. INSESSORES.

Tribe DENTIROSTRES.

Family LANIADÆ.—*Shrikes.*

Sub Family LANIADÆ.—*True Shrikes.*

Genus LANIUS, Auct.—Collurio, Vig.—*Shrike* or *Butcher Bird.*

48.—*L. Hardwickii.—Coll. Hardwickii,* Vig—Gould Cent.—*Pechanuk,* H.—*Bay backed Shrike.*

This handsome little shrike is the most abundant of the Indian species, and is tolerably common in every part except the West Coast. It frequents gardens, hedges and cultivated ground, but chiefly delights in low, thorny, but open, jungle—feeds on locusts, grasshoppers, and also on small birds.

Bill black—Irides hazel brown; length about eight inches; tail nearly four.

49. *L. lahtora.—Coll. lahtora,* Sykes.—*L. excubitor,* var. *C. Lath.—Doodhea latora,* H.—*Large grey Shrike.*

Generally spread, except on the Western Coast, where it occurs rarely,

if at all—more abundant on the table land than below the ghauts—frequents open baubul jungle, or single trees on the open plain, or cultivated ground. Seldom approaches villages or cantonments, as the last does, but has the same habits and food.

Irides hazel brown—bill and legs black—length 9½ inches; tail 5.

50. *L. erythronotus.—Coll. erythronotus,* Vig.—*Latora,* H.—*Rufous-backed Shrike.*

This shrike is a rare bird in the Carnatic, less so in the Deccan, common on the West Coast, and most abundant on the Neilgherries. It prefers a more wooded country than the two last species—frequents low bushy ground or open spaces in the jungle, and has similar manners and food to others of the genus.

Length 10 inches; tail 4½; irides hazel brown—bill and legs black.

51. *L. nigriceps.—Coll. nigriceps,* Frank.—*Black headed Shrike.*

I have hitherto only observed this species in Goomsoor, perched on trees, at the edges of thick jungle.

Irides deep brown—length 10¼ inches; tail 5.

Sub Family DICRURINÆ.

Gen. TEPHRODORNIS, Swainson.

I think that this genus rather belongs to the *Thamnophilinæ,* or bush shrikes, judging from its manners; but as Swainson looks upon it as the union of the two families, it may retain its place among the 'swallow shrikes.'

52. *T. Sylvicola.*—New sp.?—*Pharee Latora,* H.—*Jungle wood shrike.*

This apparently undescribed species inhabits the dense and lofty forests of the Western Coast and ghauts. I have found it on the Coonoor pass, as high as 5000 feet. It climbs and hops about the larger boughs of trees, seeking for and picking insects of various kinds, but chiefly coleopterous, off the bark, and occasionally making a swoop at one it has

spied on a branch at a short distance. Seen singly, or in small flocks, when they generally keep up a noisy and harsh chattering.

Descr.—Above, slaty cinereous—an eyeband, extending from nostrils to half an inch behind the eye, black—rump and beneath white, the breast with a tinge of reddish cinereous—wings and tail dusky brown. Length 8½ inches; tail 3¼; wing 4¾; tarsus $\frac{7}{10}$ths; bill (to gape) 1$\frac{2}{10}$ths; irides greenish or wax yellow.

53. *T. superciliosus*, Sw.—*Lan. muscicapoides*, Frankl.—*L. Keroula*, Gray—Gray and Hardwicke, Ill. Ind. Zool. (bad figure).—*Common wood shrike.*

This species has been lately accurately described by Swainson,* but without the synonymes, of which he was probably unaware. It is generally spread throughout Southern India, but in no place abundant, though it is far from being rare in some parts of the country. I have seen it most numerous in Goomsoor, and in the Wulliar jungle (in the gap of Coimbatore). Colonel Sykes says it is rare in the Deccan—this is to be expected, from the bareness of the country. Though never found in dense jungle like the preceding one, the wood shrike is found in open jungle, in open spaces on the borders of thick forests, woody nullahs, topes, avenues, and even thick hedges occasionally. It has similar habits with the last; slowly traversing the branches of the trees it frequents in search of insects, chiefly coleoptera. Like it also it hunts in small flocks, or singly.

Length 6½ inches; wing 3½; tail 2¾.—Irides greenish wax yellow (as in the last).

Gen. OCYPTERUS, Cuv.—*Swallow Shrike.*

54. *O. leucorhynchos.*—*Ash-coloured Swallow Shrike.*

Appears to be universally spread over India; but is by no means common, and I have had very few opportunities of observing it. It prefers a wooded country, and always I believe takes its food, which consists chiefly of soft winged insects, in the air. I saw a flock once flying over an open space in the Wulliar jungle like swallows; again near Palamcottah, in a palmyra tope, a small flock of them, one every now and then darting

* *Two Centenaries and a Quarter of Birds, either new, or hitherto imperfectly described.—Animals in Menageries*, Part 3, No. 9:—Lardner's Cabinet Cycl.

from its perch on the top of a palm-tree,and making a short circuit in the air after insects, reseating itself, though not generally on the same tree. On another occasion I saw it in Travancore skimming over the surface of a tank, and returning to rest on a low bough over-hanging the water. Its flight is rapid, elegant, and remarkably like that of the swallow.

Length about 7 inches ; wing 5; tail 2 $\frac{2}{10}$ths; bill light cinereous, darker at tip ; legs slate colour.

Gen. DICRURUS, Vieill.—Edolius, Cuv.

Drongo Shrike.—Fork tailed Shrike.—King Crow of Europeans in India.

55. *D. balicassius*, Vieill.—*Common King Crow.—Kolsah* or *Bojunga*, H.—Sometimes also called "*Cotwal.*"

This is the most common and abundant species of *Dicrurus*, and is to be met with in every part of the country, and inhabits alike the open country and wooded districts, but is never found in dense jungle. The king crow may be seen perched on a tree or hedge, the top of a low bush on the plain, or a stack of grain—frequently also on the top of a wall or old building, the bank of a paddy-field, or even a clod of earth,or ant hill—and it is by no means uncommon to see one on the back of cattle, sheep or goats,while grazing. From this perch it watches eagerly for the stirring of an insect below—on observing one, flies rapidly to the spot, and, generally alighting for an instant on the ground, seizes its prey—frequently however the devoted grasshopper, or other insect, being also on the look-out, makes an attempt to escape, but is closely pursued by the king-crow, who either snaps it up on the wing or just as it has alighted. Having secured it, the *kolsa* flies off generally, but not always to its former perch, devours it at leisure, and then uttering its usual cry is again ready for a fresh capture. Such is the usual mode of feeding of this bird. It very frequently, however, captures various mall insects on the wing, from the top of a tree or some lofty branch, sometimes ascending almost perpendicularly for several feet—occasionally whips one off a blade of grain, or from the surface of a pool of water. On the issuing of the winged termites from a nest in a hedge row, or near the bottom of a tree, there are generally several assembled to partake of the feast, together with the crows and minas. This bird gets its popular name of king-crow from its general habit of following crows most clamorously and persevering, every now and then pouncing

down on them, though it seldom strikes. It pursues kites and various other birds also, whence one of its common Hindostanee names (*cotwal*). In the bare Deccan I have often seen one or two king-crows high in the air, traversing the country, but apparently not hunting.

The usual cry of this shrike is a sort of crow or chuckle, succeeded by two or three sweeter notes, but it has several other cries. It is the first bird whose song is heard in the morning, often long before sunrise, and sometimes on moonlight nights throughout the whole night. Its flight is in general undulating, not very rapid, performed with few flappings; but when it exerts itself after a crow or other bird, it is capable of great speed, and always overtakes its enemy with ease. It occurs singly or in small families. I once found its nest, in the month of August, in the Carnatic, situated in the fork of a banian tree, at a moderate elevation—it was composed of twigs and roots, carelessly put together, and without any lining, and contained three eggs, white, sparingly spotted with purplish red. Its chief food is grasshoppers of various kinds, also bees, moths and other insects, chiefly coleopterous. Mr. Elliot in his notes says, it migrates from the Southern Mahratta Country during the monsoon. In the Carnatic I never observed any diminution in its numbers at any season, but in the northern part of the Deccan (at Jaulnah) it certainly becomes much more rare at that time, and indeed is hardly met with. The *kolsa* is occasionally tamed, and will perch on the head or hand of its master, and fly down after a grasshopper or other insect.

Length 12 inches; tail $6\frac{1}{4}$; wing $5\frac{3}{4}$; 4th quill perceptibly larger than the 3d and 5th, which are about equal—tarsus a little more than $\frac{7}{10}$ of an inch.

56. *D. cœrulescens*, Vieill.—*Lan. Fingal*, Shaw.—*E. leucogaster*.—*Pharee Bojunga*, H.—*White bellied king-crow.*

This species appears to be generally spread, but no where plentiful. It frequents open though lofty jungle, and well wooded districts, but is occasionally met with in topes and avenues in the Deccan and Carnatic. I have seen it most numerous in the Wulliar jungle, and the Segour pass of the Neilgherries, where I found it at a considerable elevation. It almost always captures its insect prey on the wing (sometimes however picks one off the ground); it perches near the top of a high tree, whence it pounces on its prey generally at no great distance. It has a sweet

song, not to be compared, however, to that of one of the genus hereafter mentioned. Irides blood-red.

Length $9\frac{1}{2}$; tail nearly 5; wing $4\frac{3}{4}$; tarsus nearly $\frac{7}{10}$, much weaker than that of *balicassius*.

57. *D. Macrocercus*, Vieill.?

This is the rarest of all the Indian *Dicruri*. I have hitherto only seen it in the Segour pass, and on the summit of the Neilgherries, in both places on lofty and tolerably dense jungle. I observed it in the former place sally from its perch near the summit of a lofty tree, and make a considerable circuit, apparently capturing several insects, and then reseating itself on some other tree. Several birds were thus engaged together, though at some distance from each other, and returning separately each to its own perch. In this respect it makes a nearer approach than any other Indian species to the manner of the African Drougo shrikes, as described by Le Vaillant, hunting in flocks like swallows, and mentioned by Swainson as being the general habits of the genus. Flight of this species similar to that of *balicassius*, but more rapid and elegant.

As I cannot be certain of this being the species indicated by Vieillot, I add a description. Above, glossy bluish black—beneath, dusky, blackish, with a faint gloss of bluish; wings and tail brownish black, with a faint gloss of bluish also—under tail coverts (in my specimen) edged with white—bill and feet black—bill more depressed than in *balicassius*, somewhat similar to that of *D. cærulescens*, but differs also from that.

Length nearly 11 inches; tail very nearly $5\frac{1}{2}$; wing 5; tarsus about half an inch; tail feathers more slender than in either *balicassius* or *cærulescens*. The chief peculiarity of this species is its short and feeble tarsus and foot.

58. *D. æneus*, Vieill.—*D. muscipetoides*, Hodgs.—*Bronzed Drougo Shrike.*

This species is always found in the most dense and lofty jungle. I have only seen it in the forests of the Western Coast, and have met it at an elevation of 4000 feet. It is generally found in small parties—stations itself near the top of some lofty tree, whence it makes frequent short sallies after insects, exactly like the flycatchers, and returns generally to the same branch. It sings most charmingly, being perhaps

only surpassed by the *Gryllivora longicauda.* Its food consists of various insects, both hard and soft winged. The name of *Muscipetoides*, given by Mr. Hodgson (Indian Review No. viii), is peculiarly appropriate, as well from the form of the bill, which is weak and highly depressed, as from the similarity of its habits to those of the flycatchers; and, if there is any doubt as to its being the *æneus* of Vieillot, should be adopted at once.

Length 9 to 9½ inches; tail 4½; wing 4¾; tarsus ½ inch; irides dark brown; bill and legs black.

59. *D. retifer.—Lan. Malabaricus*, Shaw.—*Bherm* or *Bhring raj* H.—*Kate-ongal*, Mahr.—*Racket tailed Drougo Shrike.*

This splendid bird is tolerably abundant in many of the lofty jungles of the west of India, both above and below the ghauts, it being very plentiful in the Wynaud district. It appears to wander more in search of its food than other of the *Dicruri*, flying from tree to tree at no great elevation, making an occasional swoop at an insect on the wing, or whipping one off a branch; frequently, however, it feeds like its congeners from a fixed station.

It generally hunts singly or in pairs, occasionally, however, it is seen in small parties. Its food is chiefly large coteopterous insects, also large bees and wasps. It has a very peculiar cry, consisting of two parts, the first a sort of harsh chuckle, ending in a peculiar metallic sound, something like the creaking of a heavy wheel. Mr. Elliot says on this subject "its general note is a deep sonorous cry something like *tse-rung, tse-rung, tse-rung.*" It has many other notes besides this; all of which however, have more or less clangor or metallic sound. I have seen it pursue a bird of prey (*Hæmatornis undulatus*, Gould) in the same manner as the common king-crow. It moults about September. Although it chiefly inhabits lofty jungles, I have seen it in comparatively low jungle, and I am informed that it often enters gardens in the cantonment of Cannanore. The *Bherm-raj* is occasionally taken and tamed: it used to be very frequently in former days, and sold for a very high price at Hyderabad. It is said to imitate the notes of all other birds, and hence is also called the '*Huzar Dustan*,' or bird of a thousand tales.

Length to end of true tail, 14 inches; length of ordinary tail 6¾; long tail feathers beyond 12, or more, even; irides dark hazel brown; wing 6¼; tarsus $\frac{9}{10}$ or nearly an inch; bill and legs black.

Sub Family CEBLEPYRINÆ, Swainson.—*Caterpillar catchers.*

Genus CEBLEPYRIS, Cuv.—*Spiny rumped Shrike.*

60.—*C. Papuensis.—Graucculus Papuensis,* Temm.—*Large spine rump.*

This bird prefers well wooded situations, though not a denizen of thick jungle; hence is most abundant in the Western Coast. It is also found in the other ports of India in topes, avenues, palm groves, and occasionally even enters gardens. It lives partly on insects, chiefly mantides, grylli, caterpillars, and soft insects, which it searches for among the foliage of large trees; and partly on fruit, especially the fig of the banian tree. It is rather a shy and wary bird; flying before you from tree to tree, uttering, as it alights, two or three rather sweet and mellow notes; but it has also a very harsh rattling scream. It flies in an undulating manner, with few vibrations of its wings. Its flesh is eaten and esteemed by some of the natives.

Irides fine lake red; length about 12 inches; of wing 6½; tail 5; tarsus nearly an inch.

61.—*C. fimbriatus,* Temm.—*Smaller spine rump.*

This, like the last species, is most abundant in woody country, and therefore on the West Coast, but is also found in the other parts of the country in avenues or thick hedges, gardens, &c. It is to be met with at all seasons on the Western Coast, but I think only repairs to the Carnatic (I speak particularly of the country about Trichinopoly), after the commencement of the rainy season there, in October or November: at all events it is much more numerous then. This spine rump hunts singly, or in small families of both sexes, flying from tree to tree, slowly and carefully examining the foliage, prying searchinglyall around, and under the leaves, to discover a suitable morsel. It continues its search hopping, flying from branch to branch, till the tree has been well inspected, when the flock flies off together to another tree. Its favourite food is caterpillars, pupæ, grubs, and soft insects, but also ants and coleopterous insects. My specimen, both of male and female, correspond pretty exactly with the description in Lesson '*Manuel d' Ornithlogie.*' The females appear much more numerous than the males, but *this* may partly be accounted for by the *young males* being clothed in the female garb.

Irides reddish dark brown; length about $7\frac{1}{2}$ inches; of wing 4; tail 3; tarsus about $\frac{7}{10}$ths.

62.—*C. Canus.*

I have not hitherto been fortunate enough to meet with this species of *spine rump*, and there is such a contrariety of description in the published accounts I have met with, that I wish Colonel Sykes had given a description of his species, which I suspect after all only to be the adult male of the last.

Genus PHŒNICORNIS, Sw.—*Red bird.*

63.—*Ph. princeps,* Vig.—Gould Cent.—*Large red bird.*

I shot one specimen of this splendid bird in a dense and lofty jungle in Goomsoor, hopping about the upper branches of high trees, and only once again observed it. At this time, which was just before the commencement of the hot season, and when insects were least abundant, it descended to the ground to pick up an insect, and returned immediately. This habit, I, on several occasions about the same time, saw resorted to by other birds, from whose usual manners it was equally foreign, viz. true flycatchers (*M. Banyumas* and *M. Melanops*); on the same tree was a grey and yellow bird of the same size, which, judging from analogy, was the female. In the stomach of the one I killed were the remains of various insects chiefly coleopterous.

Length of my specimen 9 inches; of wing 4 $\frac{2}{10}$ths; tail 4; tarsus nearly $\frac{8}{10}$ths.

This splendid species differs from *P. flammeus,* which sometimes nearly approaches it in size, in the length of the wing and tarsus, as well as in the infinitely richer hue of the red.

64. *P. Brevirostris,* Vig.—Gould's Cent.—*Short billed red bird.*

I was also fortunate enough to meet with this well marked and distinct species in Goomsoor, and procured three individuals, an adult male, a young male and a female. It had the same manners as the last, frequenting the tops of high trees—on one occasion, however, I observed a flock of the females hunting together over a thick hedge. In the stomach of those I killed fragments of coleopterous insects only were observed.

The short billed red bird has been most justly separated from *P. flammeus*, as well from its deeper shade of plumage as from various structural points of difference. The female does not differ from that of *P. flammeus*, except in the structural points, and a somewhat duller shade of yellow. The young male I possess has the grey upper plumage of the female—beneath white with a reddish tinge, and the red marks on the wings and tail nearly developed.

Length 8 inches; tail 4; wing $3\frac{1}{2}$; tarsus less than $\frac{6}{10}$ of an inch; feet much smaller than *P. flammeus*. I see that Swainson supposes this species to be synonymous with *P. miniata*.

65. *P. flammeus.*—*Musc. flammea*, Auct.—*Pharee Boolal Chusm* H.—*Common red bird.*

This species of red bird is tolerably abundant in most of the lofty jungles of the Western Coast—both above and below the ghauts; and I have seen it as high as 5000 feet on the Coonoor ghaut of the Neilgherries. It is, I think, more abundant on the table land of the Wynaad, than in most other places I have observed it in. It is a restless bird, wandering from tree to tree, examining the loftiest branches in search of various insects and their larvæ, which constitute its favourite food. It is either found singly or in small parties of three or four, and the sexes are generally seen apart from each other.

Irides dark brown; length 8 to $8\frac{1}{2}$ inches; of wing, 3 $\frac{7}{10}$; tail $3\frac{1}{2}$ to 4; tarsus not quite $\frac{7}{10}$.

66. *Phœnicornis peregrinus*, Vig.—Gould Cent.—*Parus peregrinus*, Auct.—*Boolal Chusm*, H.—*Small red bird.*

This pretty and lively little bird is more numerously and extensively spread than any of its congeners, and is to be found in most woody situations even in the dry Carnatic, in jungle and in thick hedges and avenues occasionally, and in some of the larger topes in the Deccan it may also be occasionally seen. It is, however, most abundant on the West Coast. It is a restless and active little creature, ever engaged in diligently examining the extreme branches of trees, gleaning among the foliage, and hanging from the slender twigs like a titmouse. It feeds upon various larvæ (which are its favourite food) and small insects.

Irides brown; length 6 inches; of tail 3.

Fam. MERULIDÆ.—*Thrushes.*

Sub-Fam. BRACHYPODINÆ.—*Short legged thrushes, or Bulbuls.*

Gen. HYPSEPETES, Vig.—*Drougo or black Bulbul.*

67.—*H. Ganeesa*, Sykes Cat. No. 49.

I have not yet been fortunate enough to meet with this bird (which I see has been lately figured in Jardine's Illustrations of Ornithology, new series No. 1), so transcribe part of Colonel Sykes' account. "Flight very rapid, found only in the dense woods of the ghauts, stony fruit found in the stomach."

68.—*H. Neilgherriensis.*—New species.—*H. psaroides*, Vig.—Gould Cent. H. B.—*Neilgherry Black Bulbul.*

This species of *Hypsepetes*, though very strongly allied to the Himalayan species, I am inclined to consider distinct, as it varies permanently in size and some markings.

Descr.—It has the same glossy black lanceolate feathers of head and hind neck, the same grey tint of the body, and blackish tail; but differs in having the quills entirely black, instead of being grey, tipped only with black; wants the small black streak running back from the eye, and has the under tail coverts edged with white.

Length about 10 inches; of wing 5; tail $\frac{2}{10}$; tarsus $\frac{6}{10}$; bill and legs orange red; irides brownish red.

If new, it may be named as above from its locality, or it might be named *Atripennis*, in contradistinction to the Himalayan species it so much resembles. I have hitherto only found this bird on the summit of the Neilgherries, in the dense woods of which it is very abundant. It lives in small flocks, feeding on various berries and fruit, generally on the top of trees. I on no occasion found any thing but fruit of different kinds, but chiefly stony, in its stomach. It usually keeps up a lively and agreeable warbling, which it continues during its occasional flight from one tree or patch of wood to another. Its flight is undulating, and not very rapid. Its manners on the whole much resemble those of the bulbuls, with which they have been classed, and justly so, I think by awinson.

Genus BRACHYPUS, Swainson.

69.—*B. rubineus.*—New species.— *Inos concolor,* Temm.?—*Ruby throated Bulbul.*

This species approaches in colour the *Turdus dispar*, Horsf. (or *T. concolor*, of Temm. P. C. 137), a native of Java, but appears, from the description I possess, to be distinct, and if so may be named as above. I have only met with the ruby throated bulbul in the forests of Malabar, and even here it is rare ; it frequents the more open spaces of the jungle, and generally prefers thickets in the neighbourhood of waters. It lives in small families, is sprightly and active, hopping about the smaller branches of trees, uttering now and then its pleasant twitter, much in the manner of the common crested bulbuls. It lives on various fruit and berries.

Descr.—Head and cheeks pure glossy black; plumage above yellowish green; chin spot black; throat of a beautiful shining ruby red; the feathers much divided and somewhat bristly; rest of the plumage beneath yellow; quills with a tinge of dusky on their inner webs; feathers of the back loose and discomposed; irides light yellow; bill black; legs greenish dusky. Length about 6½ inches; of wing 3; tail 2¾; tarsus rather more than ½ an inch.

70. *B. priocephalus.*—New species.—*White eyed Bulbul.*

Descr.—Crown of head, occiput and throat bluish grey—forehead siskin green. Backwings and beneath, oil green, lighter towards the vent. Rump feathers light yellowish green, broadly streaked with black, as in '*B. entilotus,*' Jard. Tail, with centre feathers greenish, broadly edged with grey, lateral do. black, also broadly terminated with light grey. Under tail coverts light grey; irides bluish white; bill and legs of a green horn colour; length 7 inches; wing 3; tail 2 $\frac{8}{10}$; tarsus about half an inch.

I only once saw and obtained a specimen of this bird near the foot of the Peria pass in Malabar. Its manners and food are similar to the last. It very much resembles in colouring a new species lately figured in Jardine's New Ser. of Ill. of Ornith. *B. entilotus*, an inhabitant of Malacca, especially in the markings of the rump feathers, but is less, and otherwise varies. Stony fruit found in its stomach.

GEN. CHLOROPSIS, Jard. and Selby.—*Emerald or green Bulbul.*

71. *C. Aurifrons*, Jard. and Selby.—*T. Malabaricus.*—*C. Sonnerati* Jard. female.—*Golden fronted green Bulbul.*

I have only found this elegant species in the forests of Malabar and other parts of the West Coast. On the Coonoor pass I have seen it above 4000 feet high. It hops and flies actively about the branches of trees, frequently at no great height, and lives on both fruits and insects, chiefly the latter, which it seizes on the branches or leaves. It is generally found in pairs or singly, occasionally three or four together. Irides light yellowish brown; bill blackish; legs cinereous.

The female, which either appears to be undescribed, or to be the *C. Sonnerati?* of the proposers of this well marked genus, differs from the male in wanting the golden forehead, and in the black gorget and blue maxillary streak, being somewhat smaller. Bill rather more lengthened than in next species. Length $7\frac{1}{2}$ to 8 inches; wing 3 $\frac{8}{10}$; tail nearly 3; female somewhat smaller.

72. *C. Cochensinensis.*—*Melliphaga Javanica*, Horsf.—*Common green Bulbul.*

This species is much more generally dispersed than the former one, being found wherever there is thick or lofty jungle. I have seen it in Goomsoor, and the Tapoor pass on the eastern side of India, and it is far from being uncommon on the West Coast, even in wooded cultivated ground and gardens. Its habits are similar to the last. I have seen it, while feeding on insects, take an occasional flight of a foot or two, to secure an insect that was attempting to escape. Its most usual food however, is fruit of different kinds. As there appears to be some doubt of the plumage of both sexes, I shall here briefly describe their differences.

Male, with chin, throat and gorge deep black, surrounded by a greenish yellow band, which extends through the eyes to the forehead—maxillary streak, hyacinth blue.

Female, with parts black in male of a light bluish green, surrounded (as in the male) with the yellowish band—maxillary streak light azure. Length $7\frac{1}{4}$ inches; wing $3\frac{1}{2}$; tail $2\frac{3}{4}$. Irides light brown; bill dusky; legs cinereous.

Genus IORA, Horsf.

73. *I. tiphia.—Motac-typhia,* Brown, Ill. Zool. pl. 36.—*Show Bheegah,* or *Show Bheegee,* H.

This is one of the most common Indian birds in most part of the country, daily to be seen in almost every garden. Its habits are even still more active and restless than those of any others of this family, being much like those of the titmouse. It may be seen diligently and carefully searching the smaller branches and twigs of trees, climbing actively among them, peering under the leaves, and occasionally hanging, like a titmouse, from a slender twig, all the while keeping up a loud warbling strain, or a low querulous sort of note, very different from each other. It is not confined to cultivated ground, but is also an inhabitant of the open spaces of jungles. Its flight is performed by a succession of quick vibrations of the wing, and causes a loud whining sound. Its food consists of various insects, and their larvæ, spiders, &c. I have only found the male bird at certain seasons in its full plumage of black and yellow, and even then you seldom meet with two clothed exactly alike. On this account, I am inclined to think, that it is only in the breeding season that the black plumage is put on, and that the *Iora scapularis* of Horsfield may be identical with both sexes of this in its ordinary plumage. This supposition, however, needs further enquiry. I once in the West Coast, in the month of Septmber, met with a nest of this species in the fork of a low tree. It was more neatly and carefully made than any other of the few nests I have seen in this country. It contained young ones. It gets its Hindustanee name from its cry, being said to repeat the syllables 'show bheega,' 'show bheega,' before rain.

Genus TRICHOPHORUS, Temm.—*Bristle necked Thrush.*

74. *T. virescens.—Ixos virescens,* Temm. P. C.—*White browed bristle neck.*

Although I am inclined to think that this species of bulbul may enter into Swainson's genus, *Andropadus* rather than *Tricophorus,* as I have in some cases, though not in all, detected a slight crenation at the tip of the upper mandible, and the bill is shorter than in *Tricophorus,* yet I have for the present kept it in that genus, as its nuchal hairs are very distinct. It is a widely dispersed, though not very common bird,

except in some few localities. It prefers a wooded district. I have found it in Goomsoor in open jungle; in the Carnatic seldom, and only in the vicinity of jungle, in thick hedges and bushy nullahs; in the neighbourhood of Coimbatoor; in low thickets, in the Wulliar jungle, and very abundant in a bushy tract along the West Coast. It flies actively along from bush to bush, hiding itself in the thickets; has a loud clear thrush-like warble, and feeds entirely on fruit of various kinds. Irides blood red; bill black; legs dusky. Length 7½ inches; wing 3½; tail 3½ tarsus nearly $\frac{9}{10}$.

75.—*T. Indicus.*—*Turdus Indicus*, auct.—*Merle olive des Indes*, Vieillot—Encyc. Method. p. 667.

I am not aware whether this well marked species of *Tricophorus* has been named or not, but as it appears to correspond with *Turdus Indicus* of the older authors, I have no hesitation in applying that specific name. This bristle necked thrush frequents only thick and lofty jungle on the West Coast, being found occasionally as high as 5000 feet. It lives in small flocks, flying from tree to tree, and keeping up a continual, and pleasing bulbul-like warble. In all the specimens I have examined, I have found fruit only in its stomach, but from the strong bristles at the base of the bill, I suppose it may, at certain seasons, partake of insects. I add a brief description.—Above olive green; eye streak extending to the forehead, and beneath yellow; quill feathers dusky on internal web; tail olive, beneath shafts of the feathers yellow*; bill and legs black; irides blood red. Length 7½ to 8 inches; wing 4; tail 3½; tarsus rather more than $\frac{7}{10}$.

Genus HÆMATORNIS, Sw.—*Crested Bulbul.*

76.—*H. Cafer.*—*Lanius Emeria*, Shaw.—*Bulbul*, H.—*Common Bulbul.*

This is one of the most common and abundant birds of India, frequenting both gardens and cultivated ground, and low bushy jungle. It is never found in dense jungle. It is found even on the Neilgherries at Coonoor and Kotagherry at 6000 feet of elevation; but I have not observed it in the more elevated and central parts of the hills. It lives in

* I see a new species from the Himalayas has lately been described by Gould (Proc. Zool. Soc. 1836), which if really distinct differs only in being crested.

pairs, or small families, feeds chiefly on fruit, being destructive to pease and other garden produce, but also occasionally on insects, frequently repeating its usual note while hopping about the branches, and wandering from tree to tree. It flies in a direct manner with a quick flapping of its wings, and usually uttering its note when on the wing. It is very commonly caged in the Carnatic, and kept for fighting, which it does with some spirit, and it is said that the antagonists often seize each other by the red under tail coverts, and endeavour to pull them out. The bulbul is also said to imitate the notes of various other birds in confinement.

77.—*H. jocosus.*—*Lanius jocosus,* L.—*Pharee Bulbul,* H.—*Hill or jungle Bulbul.*

This sprightly and pleasing bird is in general found in the Peninsula, only in lofty jungle, as well as on the East Coast (as in Goomsoor), as the West Coast; but I have also seen it in low bushy ground on the sea coast, between Calicut and Tellicherry, and it is most abundant on the summit of the Neilgherries, in gardens, and shrubby ground. It is a most lively and active bird, always on the move, and warbling its pleasant chirruping notes, which are much sweeter than those of the common bulbul. It lives chiefly on fruit and seeds, but also on insects occasionally, which I have seen it picking off the ground. Its flight is like that of the last, steady, but not rapid, and its crest is never erected during flight, but always the moment it alights. A deserted nest was pointed out to me, in a low shrub close to a house in Ootacamund, as that of the hill bulbul. It was very neatly made with moss, lichen, small roots and twigs, and well lined with hair and down.

Irides yellow brown; length varies from 7 to 8 inches. Specimens from the Neilgherries are larger than those from the coast.

Sub-Family MYOTHERINÆ, Swainson.—*Ant Thrushes.*

Genus MYOTHERA, Ill.

Sub Genus BRACHYPTERYX, Horsf.—*Short-wing.*

78.—*B. atriceps.*—New species?—*Black-headed short wing.*

I know not if this little species has been described or not, so shall for the present consider it as new. It is only found, as far as my observations extend, among the thickest underwood in dense lofty jungle. I have seen it in the Trichoor and Wurguncherry jungles, and also on the Coonoor ghaut, and in the Wynaud. It is a restless lively little bird

living in small flocks of five or six, and continually hopping about the low thick bushes and underwood, with an incessant low twittering note, and has much of the general habits of the *Thimaliæ.* In its stomach I found small mantides, grasshoppers and other insects.

Descr.—Head and cheeks black; back, wings, tail, and under tail coverts brownish olive, darkest on tail and wings; below white with a tinge of olive, brown on the sides, and towards the vent; feathers of back and rump much discomposed. Length nearly $5\frac{1}{2}$ inches; of tail 2; of wing $2\frac{3}{10}$ths; tarsus $\frac{8}{10}$ths. Irides pale orange buff.

GENUS MYOPHONUS, Horsf.—*Fowl Thrush*, Swainson.

79.—*M. Horsfieldii*, Vigors.—*Large blue Thrush.*

I have hitherto only seen this bird twice: once in the Trichoor jungle, hopping on the ground like a black bird; and again in the Segoor pass of the Neilgherries, flying before me from tree to tree near the ground. I have also seen a specimen shot in the Pulney hills, and several procured in the neighbourhood of Cannanore. Length 12 inches; of wing $6\frac{1}{4}$; of tail 5; of tarsus $1\frac{8}{10}$ths of an inch. Bill and legs black; irides dark brown.

GENUS PITTA, Temm.—*Ant Thrush.*

80.—*P. Brachyura.*—*Nou-rung*, H. (i. e. *nine coloured bird*).

Though by no means common, this bird is occasionally met with in gardens and topes in the Carnatic, as at Madras and Trichinopoly, during the cold weather only, I believe. It however generally frequents high jungle, and is therefore more common on the West Coast than in other parts of the peninsula; I have also seen it in Goomsoor. It feeds on the ground in small flocks, generally, but not unfrequently singly, and readily perches on being disturbed.

In the few instances when I have obtained specimens of the *Nou-rung*, I have not found their food to consist of ants, but of other insects, chiefly coleopterous. Length $6\frac{1}{2}$ inches; of wing $4\frac{1}{4}$; tail $1\frac{1}{2}$; tarsus $1\frac{4}{10}$ths. Irides, hazel brown; bill black; legs yellowish pink.

Sub-Family MERULINÆ.—*True Thrushes.*

Genus PETROCINCLA.—*Rock Thrush.*

81.—*P. Pandoo,* Sykes.—*P. Maal,* Sykes.—*Indian Rock Thrush—Shamah,* H.

In accordance with Colonel Sykes' opinion, I place this bird as distinct from the *P. Cyanea* of Europe, which it much resembles. The *Shamah* is a rare bird in the southern part of the Peninsula. I have only seen it on the Neilgherries, near Coonoor and Kotagherry, in bushy and rocky valleys. Towards the more northern parts it becomes more frequent. I observed it several times about the central part of the table land, both in the neighbourhood of villages, and in rocky valleys and hills. About Jaulnah it is far from being uncommon, frequenting chiefly the old mud walls of villages, and rocky hills, and occasionally seen about houses and stables in cantonment, perching now and then on the house tops. I first observed it this year (1839) in the beginning of October, coming in at the same time with many other birds, and it stays here (Jaulnah) till April. It is always solitary, feeds on various insects. I have found the *P. maal*, of Sykes, in the same localities as his *P. pandoo*, and consider it as the young bird or female, which is also the opinion of Mr. Elliot. From his notes I take the following extract:—" very tame, often coming into houses and hopping about verandahs; has a fine song, and is trained and domesticated by faqueers and others; common on the coast from Vingorlah to Cambay." Length 8½ inches; wing nearly 15; tail 3; tarsus 1 inch. Irides deep brown; bill and legs black.

Genus PETROPHILA, Swainson.

82. *P. cinclorhyncha,* Sw.—*Petrocincla cinclorhyncha,* Vigors.—Gould, Cent. pl.

This bird certainly differs from the last in its habits, as well as form, but the generic name adopted by Swainson is, I think, unfortunate, as I have hitherto only met it perched on trees in dense and lofty jungle in the Coonoor pass of the Neilgherries, on the summit of the hills near Coonoor—and once in the jungles of Malabar, at no great elevation above the sea. On one occasion only I observed three or four together; at all other times it was solitary. Its stomach contained various fruit and berries.

A young bird, I possess, is of a brownish olive colour above, with a tinge of blue on the shoulders and tail, rump feathers edged with rusty; beneath white, much tinged with rusty on breast, and the feathers barred transversely with olive brown. Length $7\frac{1}{2}$ inches; wing rather more than 4; tail $2\frac{3}{4}$; tarsus $\frac{9}{10}$ths of an inch; irides brown.

Genus TURDUS, L., Auct.—Merula, Sw.

83.—*T. simillimus.*—New species.—*Neilgherry black bird.*

This black bird, generally considered by residents on the Neilgherries to be identical with the European species, so closely resembles it, that I was unable to decide accurately from the descriptions I possess, till I procured some specimens from home of the British bird. It however differs invariably (besides in other points hereafter to be mentioned) in the colour of its legs, which are always yellow, whilst those of the *T. merula* are brown (I had overlooked this point in the descriptions). The *Neilgherry black bird* has exactly the same habits and song as its European analogue, though I think in this latter respect it is surpassed by the British bird.

I have only observed it on the Neilgherries, in the dense woods of which it is very common, and may be daily heard pouring forth its charming song, especially towards evening, and in cloudy weather. It is found alone or in small families. It lives chiefly on fruit of different kinds, especially of the pleasant Brazil cherry, now so abundant in the woods there; also feeds on worms, caterpillars, and other soft insects. I possess a specimen, given me by Major Campbell, 33d N. I., who shot it on the Pulney hills, which is identical with the Neilgherry ones.

Descr.—Male bird entirely black, conspicuously darkest on the head and back of neck, lightest below, and tinged with dusky brownish. Female of a dark olive brown above, of a much lighter tint below. Bill and edges of eyelids, in both sexes, orange yellow; feet dark yellow, with a tinge of dusky in the female; claws of same colour as toes. Irides dark hazel brown. Length 10 inches; of wing a little more than 5 inches; tail rather more than 4; tarsus nearly 1 $\frac{3}{10}$ths.

The young birds are of a similar colour to the females; the feathers especially of the head, neck and breast, have a central streak of a light brownish yellow. In the European bird, this central streak is of a much darker and more rufous hue. One of the chief points of difference, be-

tween this species and the European bird, is the length of bill, which is considerably longest in the Neilgherry bird. This, with the difference of colour of legs and claws, and the distinct (though slight) variation of the tint of the plumage are sufficient, I should imagine, (independent of its difference of locality), to stamp this as a distinct and independent species. It would be interesting to know if this species was confined to the small, but highly elevated table lands of the South of India, or had a more extended geographical distribution.

84.—*T. cyanotus*, Jard. Ill. Ornith.—46.—*Blue backed Thrush.*

This neatly marked species is found only in dense and lofty jungles. I have seen it in Goomsoor, in the Malabar Coast, and most numerously in the bamboo jungles of the Wynaud, though far from being common even there. It is always found solitary, perched on the lower branches of trees, and its flight is low and rapid. Feeds chiefly on stony fruit. Colonel Sykes says also on *cicadœ* and other insects. I never heard it utter any note. Irides dark brown; length 8 inches; of wing $4\frac{1}{2}$; tail nearly 3; tarsus $1\frac{2}{10}$ths of an inch.

85.—*T. varius*, Horsf.—*Elegant Thrush.*

I only once saw and obtained a specimen of this elegantly marked and formed species of thrush, in a small tope close to Rumbah, on the Chilka lake, in the neighbourhood of a high jungle; its flight was very rapid. Its stomach contained various fruit and seeds. Irides dark hazel. Length about 10 inches; of wing rather more than $5\frac{1}{2}$; tail $3\frac{3}{4}$; tarsus 1 $\frac{2}{10}$ths. The first quill is very small; the second slightly shorter than the fifth, the third longest and perceptibly longer than the fourth. Bill brownish; legs and feet dirty yellow

Sub Family CRATEROPODINÆ, Swains.—*Babblers.*

This sub-family has received a most appropriate name from Swainson, who has, I think, most justly located in it the various Indian genera *Pellorneum*, *Crateropus*, *Pomatorrhinus* and *Thimalia*, which much resemble each other in their manners, though they do not in general evince a partiality for the neighbourhood of water, nor do they inhabit the thickets of reeds and other aquatic plants, as said, in Swainson, to be the general habits of the family. The notes of all the species are loud.

[illegible] HISTORY

Crateropus Cachinnaus

Laughing Thrush of the Neilgherries

Drawn on Transfer Paper by J. Dumphy.

Printed by W. Winchester

Gen. PELLORNEUM, Swains.

86.—*P. olivaceum*?—New species.—*P. ruficeps*, Sw. N.Z?—*Red headed Babbler.*

Descrip.—Above and sides of a dark brownish olive; head, and back part of neck, rusty red; chin white; breast and belly white; many of the feathers, of the breast especially, broadly centred with olive. Irides brick red; bill above dusky; below dirty yellow; legs yellow with a tinge of flesh colour. Length $6\frac{1}{2}$ inches; wing $2\frac{3}{4}$; tail $2\frac{4}{10}$ths; tarsus $1\frac{1}{10}$th.

I have not met with any description of this bird, but as the species given as type of this genus has been called *ruficeps* by its talented founder, I strongly suspect, that, as the name is applicable to this species, it may be the one intended, so have put it as a synonym, till further information is obtained.

I have met this curious little bird in the jungles of Trichoor, Wurguncherry and Manantoddy, but it is by no means common. It associates in small flocks, among the low shrubs and thickets in lofty jungle, descending to the ground, where it hops about in search of various insects, and from thence running up and climbing the small branches, keeping up a continual chattering, and every now and then one of them, perched on a low bough, elevating his head and neck, and giving utterance to a sort of crowing laugh, very similar to that of the *Crateropus* next described. On being disturbed, they retreat through the trees and underwood, at no great height from the ground, and indeed they never appear to climb to any height.

Gen. CRATEROPUS, Sw.—Xanthocincla, Gould.—Ganulaxis, Less.

87.—*C. cachinnaus.*—New species?—*White browed Babbler.—Laughing Thrush of the Neilgherries.*

Descrip.—Above and under tail coverts of a dark olive, head dusky black, eyebrows and eyelids white, lores and chin black, ears, throat, breast and belly bright rufous. Irides fine lake red; bill black; legs dusky greenish. Length about 9 inches; wing $3\frac{7}{10}$; tail nearly 4; tarsus $1\frac{4}{10}$.

This noisy bird is to be met with in all the thick woods on the summit of the Neilgherries, and its loud laughing call is often heard when the bird itself remains unseen. I have met it in no other locality.

Like others of the family it lives in small flocks, forages about the thick brushwood, and densely interwoven woody creepers. On being observed, they hop and climb up the stem and thick branches of the nearest large tree; but they do not appear to ascend to the tops of trees. I occasionally, though rarely, observed them hopping and feeding on the ground. As might be expected from the structure of their wings, they fly heavily, and never to any distance. The cry of the 'laughing thrush' is very peculiar, and once heard cannot be forgotten. It is a sort of cracked, punch and judy laugh, and is no sooner commenced by one, than several others take up the chorus. Their chief food is fruit of various kinds, also caterpillars, grubs and various other insects.

88.—*C. Delesserti.*—New species?

The only specimen I have seen of this bird was in the collection of M. Delessert, who was some time on the Neilgherries. It was killed near Kotagherry, and, if new, may be named in honour of that gentleman, who took home with him large collections.

Descr.—Irides light red; bill yellow at the base of the lower mandible, brown above; head and nape brownish black; chin, throat and breast white, shoulders and back dark rufous, growing lighter towards the tail; wings reddish black; belly and vent light reddish brown; tail black; legs pale reddish. Length about 11 inches; wing $4\frac{2}{10}$ths; tail $4\frac{3}{10}$ths; tarsus $1\frac{5}{10}$ths.

Sub-Genus POMATORHINUS, Horsf.

89.—*P. Horsfieldii*, Sykes.—*Horsfield's Babbler.*

I have seen this bird, but rarely, in Goomsoor, in bamboo jungle, in thick and tangled wood near Manantoddy, and among under-wood in the neighbourhood of Kotagherry. It has a very loud cry which has been well expressed by Colonel Sykes, as, '*hoot whoot, whoot*,' to which the female (when they are in pairs) answers '*hoot, hooee.*' I saw it once in pairs, at other times in small families, keeping up a continual loud call, and climbing about the branches with great facility. It is a remarkably shy and wary bird. Various small insects were found in the stomach of those I procured.

Irides dark red; bill yellow; horn colour at the base of the upper mandible; legs greenish black. Length 9 to $9\frac{1}{2}$ inches; wing $3\frac{6}{10}$ths tail $3\frac{3}{4}$; tarsus $1\frac{2}{10}$ths.

Genus THIMALIA, Horsf.

90.—*T. Malcolmi*, Sykes.—*Large Babbler.*—*Ghoghoye*, H.—*Gougya*, Can.—*Kokuttee*, M.

This large *Thimalia* has a peculiar distribution. In the South of India it is only found on the elevated table lands. I have observed it on the Neilgherries near Coonoor and Kotagherry, in low bushy ground, and seen specimens from the Shevaroy Hills near Salem. It is not found in the Carnatic, Northern Circars, nor in the more southern parts of the Deccan, but towards the north begins to occur more frequently, and at Jaulnah is very common. The *Ghoghoye* frequents topes in the neighbourhood of villages and cultivation, also occasionally low and open jungle. Lives in small troops, feeding chiefly on the ground, especially around the trunks of large trees. It keeps up a continual chattering, occasionally changed to a louder cry, resembling 'quey, quey, quey, quo, quo,' pronounced very gutturally. Its flight, like that of all the species of *Thimalia*, is feeble and struggling. Mr. Elliot says "when the Shikra (*F. Dukhunensis*) is flown at them they defend each other with great courage, mobbing the hawk, and endeavouring to release the one she has seized." Lives on various grains, seeds, and insects, chiefly grasshoppers; I have seen one attempt in vain to catch a grasshopper on the wing.

Irides light yellow. Length $11\frac{1}{2}$ inches; wing $4\frac{6}{10}$ths; tail $5\frac{1}{2}$; tarsus $1\frac{3}{10}$ths.

91.—*T. Somervillei*, Sykes.—*Jungle Keir or Kayr*, H.—*Jungle grey babbler.*

I have always found this species of *Thimalia* in tolerably dense jungle, and never in open country, like the next one which much resembles it. It is far from being uncommon in most jungles. I have seen it in Goomsoor, in the Tondiman's country, in the Carnatic, and in most of the jungles of the West Coast. I have also lately procured it in a densely wooded nullah in low jungly country in the neighbourhood of Jaulnah. It has similar habits to others of the genus living in tolerably numerous and noisy troops, and feeding on various grains and insects.

Irides pale yellow; bill and feet dirty yellow. Length 9 inches; of wing $4\frac{1}{10}$th, tail $4\frac{1}{2}$; tarsus $1\frac{3}{10}$ths.

I may here remark that my specimens from two localities differ somewhat from each other in the shade of their plumage, and also slightly from Colonel Sykes' description. This may depend on difference of age. A specimen from Goomsoor, however, has a bill remarkably differing from those of the others, in having the edge of both mandibles, especially of the under one, scooped out, as it were, from the centre to the tip of the bill, so as, when they are closed, to leave an open space. I pos-

sess but one specimen from this locality, and so am not aware whether it is an accidental or permanent character. If the latter, it will, with some other slight variations, constitute it a separate species; and from the peculiar distribution of others of this truly Indian genus, and the general similarity of colour, as remarkably shown in the likeness of this to the next species, I am inclined to think that hereafter other species may be separated, closely allied in plumage and general structure, yet differing in some permanent character, both of structure and plumage, as well as in geographical distribution. This, however, deserves further investigation.

92.—*T. grisea.*—*T. griseus, Lath.*—*Keyr.* H.—*Kullee Couravee*, Tam. (*Hedge bird).—Dirt bird* of some Europeans.—*Fouille-merde* of French in India (Vieillot)—*Common Grey Babbler.*

This species so much resembles the last in its general appearance, that I was long unsatisfied of their distinctness, notwithstanding the striking difference of colour of the irides, and different localities of the two. This is one of the commonest birds of the Carnatic, and may be seen in every garden, and about the hedge rows, avenues, trees and topes throughout that district. I have never seen it above the ghauts, nor in the Northern Circars even, but it occurs sparingly in the more open portions of the West Coast. Like the others of its genus, it lives in numerous families of 6, 8, 10, or more. They feed chiefly on the ground, on which they may be seen to drop one after the other from the tree they may have been perched on—hop briskly about, picking up various seeds and insects, occasionally seeking the latter from heaps of dung (whence they have received their usual denomination, as well from the French as English in India, who on this account are prejudiced against them). On being driven from the ground or leaving it from choice, they fly up successively as they dropped down, and hop and climb up the large branches of the nearest tree, seldom stopping till they have nearly reached the top or the other side, from which if still watched they fly off, one after the other, to another tree. They often appear to pick insects off the bark of trees. They have an incessant loud whispering kind of chatter, which they all repeat at once, especially when feeding, or on being observed by any one. The *Keyr* is a very familiar bird if undisturbed feeding close to houses, but if closely observed or followed becomes circumspect and wary. It is also a very quarrelsome bird. I have seen the nest of this species placed in a tree at no great height. It was made of small twigs and roots most carelessly put together, and contained four bluish eggs. I shall here add a description of the Carnatic bird.

General shade of plumage light brownish grey, head and nape much lighter tint, almost whitish, and appearing so most distinctly at a distance (whence they are vulgarly called by some white headed bobs). Quills and tail brown, obsoletely barred with darker bands, central tail feathers lighter at the base, feathers of the back darkish, lightest in the shaft and at the edges, rump feathers pale fawn, much discomposed. Feathers of the chin and throat dark in the centre, at the base and extremity of a bluish white. This gives a bluish appearance to this gular band, which is distinctly separated from the surrounding plumage. Breast, belly and under tail coverts pale yellowish fawn colour, most of the feathers are bluish at the base.

Length $9\frac{1}{2}$; wing 4; tail 4; tarsus 1 $\frac{3}{10}$ths; irides silver white; bill and legs yellow. It differs from the last species structurally in the form of the bill, which is shorter and more elevated at the base, and in the hind toe also, which is shorter than in *T. Somervillei.*

Mr. Elliot has in his notes the description of a *Thimalia,* met in the Southern Mahratta Country, which appears nearly to correspond with this, the only difference I can detect from his description is in the bill and legs, which he calls "whitish." If identical it would mark a curious distribution, as I have seen it in no situation above the ghauts.

Plumage above, chin and throat, brown cinereous, shafts of the feathers lighter; head and nape, whitish, rump cinereous; tail brown, with indistinct darker bars; belly whitish like the head. Irides silver white, bill and legs white. Length $9\frac{1}{4}$ inches.

93.—*T. subrufa.*—New species.—*Junglee Keyr,* H.—*Rufous bellied Babbler.*

This apparently undescribed species is only found in thick jungle. I have hitherto only seen it in the bamboo jungles of the Wynaad near Manantoddy. It has similar manners to the others, feeding on the ground, and on being disturbed retreating to the thick clumps of bamboos, through which they make their way with much adroitness, chattering all the while, and generally contrive to conceal themselves from view. Their note is similar in character, though quite distinct from any of its congeners. Its colours mark an approach to the *Crateropi.* Mr. Elliot mentions this species in his notes as found in the jungles of the Southern Mahratta Country; so it is probably found in most of the elevated jungles along the range of the ghauts, though not as far as I have seen found below the mountains.

Descr.—Above darkish brown olive, below rufous, darkest on the neck and breast; forehead pale bluish ash colour; frontal feathers rigid; bill brown above, yellow below. Legs yellow, irides bright yellow. Length $9\frac{1}{2}$; wing 3 $\frac{7}{10}$ths; tail $4\frac{1}{4}$; tarsus $1\frac{3}{10}$ths.

94.—*T. Chatarœa*, Frankl. Cat.—Gen. *Malacocircus*, Swainson ?—*Doomree*, H.—*Hoonee*, Tam. ?—*Striated Babbler.*

Before entering on the account of the bird, I may here introduce some excellent remarks of Mr. Elliot. He says, speaking of the *Thimaliæ* " there is another group, the *Doomrees*, differing somewhat in habit, less noisy, still in companies and flying along woody nullahs, hedge rows, bushes, &c. where they ensconce and conceal themselves." In the three species next described there is certainly a slight difference both in structure and habits from the more typical species of *Thimaliæ*. Whether this is sufficient to entitle them to sub generic distinction or not cannot be satisfactorily determined, till a complete analysis has been made of the whole family of the *Crateropodinæ*, of which Swainson confesses that enough is not yet known to enable him to arrange them perfectly.

The *Doomree* is found all over the peninsula, in the open plains when covered with a few scattered bushes, or in low but thin jungle. It is a shy and wary bird, flying before you from bush to bush, and having a whistling sort of cry which it is frequently heard repeating. It flies low, and like others of the genus, alternately with a few rapid beats of the wing, and a sailing with outstretched wings. Feeds on various insects, caterpillars and grubs. Irides reddish brown; bill brownish; legs dirty yellow. Length 9 to $9\frac{1}{2}$; wing about 3; tail 4; tarsus 1.

95.—*T. hypoleuca*, Frankl.—*White bellied or singing Babbler.*—*Shukur Doomree*, H. ?

This neatly clothed little *Thimalia*, is far from being common towards the south of the Peninsula. I have seen it in a bushy tract at the edge of the Wulliar jungle; also in hedges on low jungly districts near the base of the Shaudee mungalum hills in the Salem district, and again at Royacottah in similar situation. Near Jaulnah it is generally to be met with in the low jungle in the neighbourhood, also in woody nullahs and thick hedges. It is not unfrequently to be seen alone, but generally in small parties of four or five, which fly before you, and manage to conceal them-

selves in some thick bush. They have a low chattering when together, neither loud however, nor often heard. I have on several occasions heard a single one perched conspicuously on a bush or hedge, pour forth a remarkably sweet song. Feeds on ants and various other insects, &c. Irides deep brown, surrounded by a narrow circle of buff; bill black; edges of the nostrils and naked skin round eye, orange yellow; legs deep yellow. Length $6\frac{1}{2}$ to $6\frac{3}{4}$; wing 2 $\frac{7}{10}$ths; tail $3\frac{1}{2}$; tarsus 1 $\frac{1}{10}$th.

96.—*T. Hyperythra*, Frankl. Cat.—*Shah Doomree*, H.?—*Smallest babbler*.

This small species, but for its high and strongly compressed bill, might readily be mistaken for a *Prinia* or some other of the warblers. I have seen it but very seldom, once at the top of the Tapoor pass in thick jungle, and in the neighbourhood of Jaulnah, in jungly district, in thick hedges, and thick wooded nullahs. From the dense nature of the bushes &c. it frequents, it is with difficulty observed and obtained. I have generally seen it in parties of five or six, occasionally giving out a low and indistinct sort of chattering. Fragments of various insects were found in the stomachs of those I procured. Irides yellowish brown; bill horn colour; legs flesh coloured with tinge of yellow. Length $5\frac{1}{2}$; wing 2 $\frac{2}{10}$ths; tail $2\frac{1}{4}$; tarsus, nearly $\frac{9}{10}$ths.

Sub Family ORIOLINÆ.—*Orioles.*

Genus ORIOLUS, L.—*Oriole.*—*Mango Bird* of Europeans in India.

97.—*O. aureus*, Gmel.—*O. Galbula*, Sykes' Cat.—*O. Kundoo*, Sykes—*Young bird*—*Peebeck*, H.—*Indian Oriole or Mango bird.*

This species, generally considered to be identical with the European, *O. Galbula*, differs in the black eye-streak extending to some distance above the ear coverts, and in its shorter wing.

Colonel Sykes says of this bird "very abundant in the Deccan just before the rains." In the Carnatic it is most abundant, I think, during the cold weather, disappearing or nearly so during the hot months. This corresponds with the period of their greatest abundance in the Deccan. It is most numerous in the West Coast, and well wooded situations; frequents topes, gardens, avenues and large single trees, feeding on various fruit, especially the fig of the banian tree. It is not met with in thick forest jungle. Its flight is undulating. It has a loud

mellow plaintive cry, something resembling *pee-ho*. Length $9\frac{1}{2}$; wing $5\frac{1}{2}$; tail $3\frac{1}{2}$; tarsus $\frac{8}{10}$ths; bill brownish red; irides fine lake red; feet slate colour.

The *O. kundoo,* of Sykes I consider the young bird.

98.—*O. melanocephalus*, L.—*Black headed Mango bird or Oriole.*

This species is in general only met with in thick and lofty jungle, but in parts of the West Coast, as about Palghaut and Trichoor, it is common in topes, avenues and gardens. I have seen it also in Goomsoor in open jungle, but not in the Carnatic. Like the last, it is seen singly, or in pairs. Length 9 inches; wing 5; tail $3\frac{1}{2}$.

99.—*O. Chinensis,* Gmel.—*O. hippocrepis*, Wagler.—*O. Maderaspatanus*, Frankl. Cat., Young bird ?—*Black-naped Oriole.*

I have not myself observed this species of *Oriole*, but find it recorded in Mr. Elliot's notes, as occurring sparingly in the jungles of the Southern Mahratta Country.

Genus IRENA, Horsf.

100.—*I. puella*, Horsf.—*Edolius puellus,* Temm.—*Fairy blue bird.*

This most lovely plumaged bird is far from being uncommon in many of the lofty forest jungles of Malabar. I have seen it in the jungles near Palghautcherry, Trichoor, the Wynaad, and on the Coonoor ghaut, as high as 4000 feet and upwards. It is only found in the densest portions of the jungle.

The fairy blue bird lives generally in small parties of four or five, or more, occasionally in pairs, frequents the loftiest trees near their summit, and feeds on various fruit and berries. It has a loud, mellow, agreeable warble, which it is frequently heard repeating; by which I have generally first detected their presence in the thick and umbrageous parts of the forest they inhabit. As this bird was not observed either by Mr. Elliot, or Colonel Sykes, I presume it does not extend far to the northward. In one or two instances, I observed two or three hairs arising from the nape, as in the *Tricophori*. Irides fine ruby red; bill and legs black. Length 10 inches; wing $5\frac{1}{4}$; tail 4; tarsus $\frac{6}{10}$ths.

Fam. SYLVIADÆ.—*Warblers.*

Sub Family SAXICOLINÆ—*Stonechats.*

Gen. GRYLLIVORA, Swains.—Kittacincla, Gould.

101.—*G. intermedia*, Sw.—*Gracula Saularis*, L.—*Turdus Amœnus*, Horsf.?—*Pastor*, Temm.—*Lan. Mindanensis*, Auct.—*Little Indian Pie*, Edw. pl. 181.—*Dial bird*, Lath.—*Dayyur or Deyr*, H.—*Large or Magpie Robin.*

This bird, so long with others of its genus banded about by authors, has at length, I hope, found a firm resting place among the *Stonechats*, to which it is certainly most closely allied in manners, as well as in structure. I think that this generally spread Indian bird, is referable to Swainson's* species named as above. It is far from being numerous in the Carnatic, or Deccan, except in well wooded situations; is more so in the Northern Circars, but most abundant on the Western Coast, as well in the jungles, as in gardens, avenues, topes, &c. It is solitary, frequents thick trees and bushes, feeds on the ground, flying down from a low branch, its usual perch, and frequently hopping a few steps on the ground, jerking its tail well up every now and then. On securing an insect it flies back again to its perch, elevating its tail on reseating itself, and uttering a pleasant warble. Towards evening it may often be seen near the top of some lofty tree in the jungle, pouring forth its agreeable song; which, however beautiful, must yield the palm to that of the next species mentioned. It is occasionally caged for its song. Its chief food is small grasshoppers and similar insects. Irides hazel brown; bill black; legs dusky. Length $7\frac{1}{2}$ to 8 inches; wing about 4; tail 3 $\frac{8}{10}$ths; tarsus 1 $\frac{1}{10}$th.

I have hitherto procured so few specimens from different localities that I cannot say whether Swainson's new species, if it be from India, (*G. brevirostra*) be well founded or not. I possess a specimen shot in thick jungle which certainly has a smaller bill than the common species, and only 3 of the tail feathers on either side are pure white, the next one being edged with black; and as this, though a young bird, is the only one I shot in high jungle, it may turn out to be a distinct species. Another species, not uncommonly seen in cages in the Carnatic, is, I

* V. Swains. Classification of Birds. Part 5.

think, the *G. magnirostra* of Swainson—this I have hitherto not met in a state of nature, and it is said to be brought over from Malacca, Ceylon, Java, and other Eastern Islands. It sells for a high price, and sings most charmingly.

102. *G. longicauda*, Swains.—*Turdus macrourus*, Gmel.—*Long tailed thrush*, Lath.—*Long tailed Robin.*—*Indian Nightingale.*—*Abbeka*, H.

This most charming songster of the forest, is unfortunately rather rare, and only found in the most retired and impervious parts of the thickest forest jungle. I have seen it in the bottom of the Coonoor pass, and in the greatest abundance in a tract of forest west of Sultan's Battery, in the Wynaad; in both places in the densest thickets. It is solitary, perches on low branches, and hops to the ground to secure a grasshopper, small mantis, or other soft insect. When alarmed it flies before you from tree to tree at a low height. Its song is heard in the greatest perfection towards evening, and is certainly surpassed by no Indian bird, if indeed it is by the celebrated Nightingale. I believe it is occasionally caught and caged for its song in the Northern provinces, and sells for a high price at Calcutta. Irides hazel brown; bill black; legs pale flesh colour. Length 12 inches, of which tail nearly 8; wing $3\frac{3}{4}$; tarsus 1 inch.

Genus THAMNOBIA, Swains.

103. *T. fulicata.*—*Ixos fulicatus.*—*Motac. fulicata*, L.—*Kulchooree*, H.—*Indian Robin.*

This well known bird (with regard to which similar remarks to those made on *Gryllivora* as to its previous situation and nomenclature apply even more strongly), is tolerably common in most parts of the country, and its familiar habits have gained for it the name of "Indian Robin." It is found mostly about villages, pagodas, walls and old buildings and houses; often perching on the roof or pandaul, and feeding in the verandahs, or occasionally even entering houses. It is generally seen single or in pairs; feeds on the ground, on which it runs with great agility, frequently pursuing and capturing several insects before it reseats itself on its perch, either on a house, or some neighbouring tree or bush. At all times, but especially when feeding, it has the habit of jerking up its tail, by successive efforts, so as almost to overshadow its head. The male has a very sweet little song, which it

warbles forth from the top of a wall or low tree—and it is occasionally caged. The *Kulchooree* is not confined to the vicinity of villages, &c. but is very common on stony hills, and in various other situations. Irides dark brown. Length 6½ inches; wing 2$\frac{8}{10}$ths; tail 2½; tarsus 1 inch.

I have twice seen the nest of the bird, once built among a heap of large stones raised from a boury, and the bird made its nest during the time the well was being blasted, and continued the process of incubation till the young ones were hatched, when it was accidentally destroyed. On the other occasion it had built its nest in a hole inside the wall of a house. It has 4 eggs, light dusky bluish colour, spotted with purplish brown.

Gen. SAXICOLA, Bechst.—*Stonechat.*

104.—*S. rubecola*, Temm.—European *Stonechat.*

I have seen this bird in all parts of India during the cold weather, making its first appearance in the beginning of October. It frequents bushes on the plains, hedges, and grain fields, and feeds on the ground on ants and various other insects. Irides dark brown; bill and legs black. Length 5¼; wing 2¾; tail 1¾; tarsus $\frac{8}{10}$ths.

105.—*S. caprata*, Vieill—*Mot. caprata*, L. P. E. 235.—*Sax. fruticola*, Horsf. ?—*Sax. bicolor* and *S. erythropygia*, Sykes.—*Indian Stonechat.*—*Neilgherry* or *Hill Robin.*—*Kala Pidda* (*i. e. Black Warbler*), *H.*

There are two varieties (of size only however) of this bird found in the peninsula. The smaller kind is found throughout India. I have seen it in the Carnatic, Deccan and West Coast—the larger variety I have only seen on the Neilgherries, but as they nearly correspond in size with those found by Colonel Sykes, there is a regular gradation from the mentioned length of the *S. fruticola* of Horsf. (viz. 4½ inches) to that of the hill variety, which reaches 6¼ inches, and as from the descriptions there appears no discrepancy in the colour of the plumage, I think that there can be but little doubt that they are mere varieties of one bird. The *S. erythropygia* of Sykes, as might indeed have been guessed from his own description, is the female of his *bicolor* (our present subject) as I have ascertained beyond a doubt—as well from dissec-

tion, as from being so universally met with together in all localities. This bird is not very common in the low country, and is perhaps most numerous in bushy and jungly districts, frequenting bushes, low trees, hedges, &c. On the Neilgherries it is extremely abundant, and there obtains the name of *Hill Robin.* It has the same manners as others of its genus, darting down to the ground from its perch on the top of a bush, or branch of a tree, and having secured an insect returning to its seat. It has a short little song, as well as the usual chattering note common to the *Stonechats*, and from which they derive their name. Varies in length from 5 to $6\frac{1}{4}$ inches. Of one $6\frac{1}{4}$ inches, the wing is $3\frac{2}{10}$ths; tail $2\frac{1}{4}$; tarsus $\frac{9}{10}$ths. Irides dark brown. Bill and legs black. The young bird is brown, spotted or streaked with light rufous.

106.—*S. rubecoloides*, Sykes.—*Indian red breast.*

This curious little species is clothed almost in the plumage of the well known European Robin. It is a rare bird. I have only seen it twice or thrice in topes in the neighbourhood of villages in the northern part of the table land. It is seen in small flocks, as well as singly, perched on the lower boughs of some large mango or tamarind tree, it hops to the ground to pick up ants and other insects, occasionally hopping a step or two, and then flying back frequently alights on the trunk of the tree, clinging to it for some seconds. It occasionally takes a very short flight from its perch, and back again, but whether to capture an insect in the air or not, I do not know. It differs from the *Stonechats* in structure, approaching the flycatchers in its broader and more depressed bill, and weak feet and legs. Irides dark brown; bill and legs brown. Length 5 inches; wing 2 $\frac{6}{10}$ths; tail 2; tarsus about $\frac{6}{10}$ths.

107. *S. nigrorufa.*—New species.—*Orange Robin.*

This prettily plumaged and apparently new species, I have only met on the summit of the Neilgherries, in the dense woods of which it may occasionally be seen, preferring the most close, retired and damp spots. Here it may be seen seated motionless on a low bough, suddenly darting to the ground to feast on a caterpillar or other insect it may have spied. I never heard its note.

Description—Head, face, back of neck and wings dusky black; rest of body bright cinnamon rufous or orange; palest on the belly.

Length about 4½ to 5; wing 2½; tail 2; tarsus $\frac{8}{10}$ths. Irides hazel brown; bill black; legs dirty reddish.

Sub Family PHILOMELINÆ, Swains.—*Large Warblers.*

Genus PHÆNICURA, Swains.—*Redstarts.*

108.—*P. atrata*, Jard. and Selby.—*Indian Redstart.*—*Thirt-hira,* H— i. e. *Trembler*, or *Quaker*, from the motion of its tail.

This bird is very common in most parts of India during the cold weather, but more so in the table land, I think than in the Carnatic. It is solitary, frequents wooded places, gardens, hedges, old walls and buildings, being often seen about the roofs of houses. Feeds on the ground on wasps, ants and various other insects. Has a most peculiar quivering motion of its tail especially after feeding. The young bird has a brownish colour, where in the old bird it is blackish cinereous. Length about 6 inches; of wing 3½; tail 2$\frac{6}{10}$ths.

109.—*P. Suecica.*—*M. Suecica*, L.—*Hoosenee Pidda*, H.—*Blue throated Redstart.*

I have not seen this beautiful Redstart in the Carnatic; and in the Deccan, it is far from being common, and is only found during the cold season, from October till March. It frequents thick hedges, gardens, sugar cane fields, and long grass or weeds in beds of tanks, &c.; occasionally coming close to houses; and feeds on the ground, on which it runs along picking up various insects, and does not return so quickly to its perch, I think, as the last species; neither has it that peculiar quivering of the tail, though while feeding on the ground, it occasionally jerks it up. It generally, when observed, tries to conceal itself among the bushes it frequents. Few of those I have seen were in perfect plumage. Irides dark brown; bill and legs brownish. Length nearly 6 inches; of wing 2 $\frac{8}{10}$ths; tail 2.

Genus PHILOMELA, Swains.

110.—*P. Orphea.*—*S. Orphea*, Temm?—*P. melanocephala?* Ill. Ornith.—*Largest Blackcap.*

Though I am far from certain that my specimens are identical with the European bird, yet from the brief and imperfect description I possess,

I conclude they may be so, if indeed it is not the species referred to in Swainson's Synopsis as *P. melanocephala*, a description of which I have not seen. This bird is found during the cold weather in hedges, thickets, large trees and gardens, and even on the low bushes on the plains. It is active and restless, moving about from branch to branch, clinging to the twigs, and feeding on various insects, grubs, caterpillars, also on flower buds. I have seen it alone, and also two or three together. It is rather an uncommon bird. I have seen it occasionally in the neighbourhood of Jaulnah, and on one occasion only in the Carnatic.

I shall here add a brief description. Head, face and back of neck, black in the male; dark slaty in the female; back and wings brownish ash grey; quills dusky brown; tail greyish black; external feathers white, with black shaft, and edged internally with blackish; next three feathers tipped with white; beneath white, with a reddish tinge on breast and belly; bill blackish horn colour; legs reddish brown. Irides dull greenish yellow. Length 6½ to 7 inches; bill ½ inch to front wing.

Genus CURRUCA, Swains.—*Phoolareea*, H. —i. e. *Flower eater or Flower pecker.*

111.—*C. cinerea*, Selby.—*S. cinerea*, Temm.—*White-throat.*

Though I have the same uncertainty with regard to this species as the last, I shall refer it at once to the European bird, giving a brief description to determine it more exactly. This is more common than the last species, but like it is only found during the cold season, remaining till March. It frequents similar situations, and has similar habits and food. I have sometimes seen them feeding on the same tree. On one occasion I observed it in the month of March very numerous in a hedge row in the Carnatic, and found it had been feeding on the pupæ of some ants, to seize which it hopped down on the ground; feeds also much on flower buds. I frequently have heard its pleasant warbling song. Irides of a reddish brown yellow.

Description.—Head and neck cinereous; ears dark; rest of outer tail feather nearly all white; rest tipped with white only; the plumage above reddish cinereous; wings and tail brownish; throat white; rest beneath white, with a tinge of reddish; bill and legs brown. Irides brownish yellow. Length 5½ to 6 inches.

112.—*C. garrula*, Selby.—*S. sylvrilla*, Penn.—*Lesser white-throat.*

I have less hesitation in referring this bird to the European species, as it is included in Colonel Sykes' Catalogue. It is more common than either of the last, frequents the same places and has similar habits, feeding on insects and flower buds, and incessantly moving about the upper and extreme branches of the trees it frequents. Irides light brownish yellow; bill blackish, pale beneath; legs dark slaty. Length rather more than 5 inches.

Genus AGROBATES, Sw.

113.—*A. brunnescens.*—New species?

Description.—Above light olive brown, darkest on wings and tail, and lightest on the rump; beneath, and eyebrow, whitish, with a tinge of olive yellow; wings and tail beneath cinereous; plumage soft and silky; bill dark brown, flesh coloured at base of lower mandible; legs horny. Irides *dull greenish yellow ochre.* This curious bird I have placed for the present as a species of Swainson's genus *Agrobates*, with which it agrees in its large thrush like bill, strong feet and legs, and slender claws; differing however in the tip of the bill being distinctly though slightly notched, and in having a few bristles at the gape. It is an uncommon bird. I have seen it in the Carnatic, near Trichinopoly; also near Jaulnah, and in other parts of the table land. In its manners this bird somewhat approaches the *Orthotomi* and *Priniæ.* I have found it in high grain fields, to the stalks of which it was seen clinging, and on being observed concealed itself among them. At Jaulnah I have lately seen it in my garden, hunting about various low shrubs, peas and beans, &c. among which, on being observed, it immediately withdrew, most carefully hiding itself, and being with difficulty driven from its place of refuge. I occasionally heard it utter a harsh clucking note. I found its food in two instances to consist of small grasshoppers and ants. Length 7 to 8 inches, of one 8 inches long the wing is $3\frac{1}{2}$; tail about 3; tarsus $1\frac{2}{10}$ths; bill above nearly $\frac{7}{10}$ths, to gape above one inch.

(To be continued.)

III.—*On Chemical Tests.—By* Lieutenant Braddock.

To the Editor of the Madras Journal.

Sir,—Having experienced the want of a book of reference on chemical tests and re-agents, I have made the following compilation, which may perhaps be found not only generally useful, but, as geological research seems to be gaining ground in South India, such a compilation may be particularly acceptable to many of the subscribers to your Journal, who interest themselves in such like scientific pursuits and investigations.

ii. That more regard to chemical testing ought to be paid by writers on the mineralogy of this part of India, seems to be evident from the following observations, for which I am indebted to Captain Campbell, Assistant Surveyor General, who has favoured me with them, and who has had occasion to make extensive experiments in the "qualitative examination" of the minerals of sundry districts under the Madras Presidency.

iii. Captain C. says, "Chemistry as applied to the examination of "minerals has been too much neglected in India.—In Europe, where "almost every mineral is known, having been examined by professional "analysts, this is of no consequence; for a mineralogist can provide "himself with examined specimens, and is able to name any newly "found mineral, by comparing it with the specimens in his cabinet. "But in India this cannot be done. Great numbers of our Indian mine-"rals are quite unknown in Europe, hardly any of them have been "analytically examined, and the comparison of them with the speci-"mens of a cabinet of European minerals is almost useless. In fact "I consider that no person can be a good mineralogist in India, who is "not also an expert (mineralogical) chemist.

iv. "The consequence of this neglect of the chemical examination "of minerals has been, that Indian minerals have been most carelessly "and incorrectly named by various writers in this country: and to such "an extent, that, as the knowledge of geology becomes more attend-"ed to in India, the descriptions of the first writers who have taken "up the subject, will become next to obsolete. Buchanan, Christie, "Malcolmson, and Benza, have all described the black pillars of "Tippoo's tomb at Seringapatam, as being hornblende, apparently "without one of them testing it even by the blow-pipe. On analysing "the mineral, I find it to be composed of silica, magnesia, alumina, "and iron: and the silica and magnesia being in the largest propor-"tion, it is therefore a silicate of magnesia; and contains no lime, "and is quite infusible, while the characteristics of hornblende are

" that it does contain lime, and is very fusible. Dr. Benza has called " a mineral which is found in the Palicondah hills, an eurite, but which " I find to be very fusible, and that it proves to be a silicate of alumi- " na, with iron and an alkali in combination. The same writer has ap- " plied the term silicious schist to a mineral, which Dr. Clark has called " hornstone, which latter term I believe to be the most correct.*

v. " The reasons why the chemical examination of minerals has " been so little attended to in this part of India are probably, first, that " the apparatus required is supposed to be too bulky for convenient " carriage; secondly, that chemical tests are not easily procured in " India, and thirdly that a chemical library is necessary.

vi. " With regard to the first reason, if apparatus was required for " experiments with gases, and for chemical purposes generally, it " would doubtless be too bulky to be portable; but as applicable to " mineralogical purposes, the *whole* apparatus required may be con- " tained in a box 24 inches long, 12 wide, and 6 deep. A common " country blacksmith's forge is always at hand as a furnace, and a " rough analysis of a mineral may be made in an afternoon in a tent.

vii. " With respect to tests, the tests and precipitants required in " mineralogical analysis are few and simple; they are easily made, " and almost every bazar affords at a small cost the materials re- " quired.

viii. " The third difficulty appears to carry the most weight, for to " acquire the knowledge necessary to conduct an analysis, many ex- " pensive works are wanted, and continual reference from one to " another is necessary to glean and arrange the information required. " Rose, is the best work on the subject, but it is perplexing to a begin- " ner, who is bewildered with a multiplicity of tests, and the elaborate " detail of precipitation and separation with which the work is filled. " Such information is indeed of the greatest value, but to the inex- " perienced analyst, who is unable to discriminate between what " it is necessary to attend to, and what may be neglected, it seems like " a labyrinth, only to bewilder and confuse; and he soon finds that " he wants something simpler." That want the following pages may perhaps in some degree supply.

ix. The sources of information that I have consulted have been the best I could obtain, but they have been almost limited to my own library, which has furnished me less copiously than I could have wished. This paper therefore I look upon only as a first imperfect attempt to form a work, which under abler hands, with some additions, would be found extremely useful to all who are not professed chemists,

* See Note at the end of this Number.—Editor.

but who are either learning that science, or who occasionally employ themselves in chemical investigations.

x. Accum's Tests by Maugham gave me the first idea connected with this compilation, and the index to his book formed an easy guide for the alphabetical order which I have adopted. His book and the following works are those to which I have been chiefly indebted for the information I have here collected and put together, viz. Rose's Analytical Chemistry translated by Griffin ; Henry's Chemistry ; Ure's Chemical Dictionary ; New edition of the Encyclopœdia Brittannica ; Joyce's Mineralogy ; some chemical tables; the London and Edinburgh Philosophical Magazine, and some other scientific Journals.

xi. I should have been glad to have made the descriptive action of the tests more satisfactory if I could, but chemical authorities I find do not always agree, and there are some great discrepancies among them. Besides, the colours and precipitates produced by re-agents are very much influenced by quantity, as well as by foreign substances that may be held in solution, so that colours especially, cannot always be correctly defined. If a test acted on a solution of one substance only, and that substance was pure, no doubt but its precise action and the colour of the precipitate might be correctly delineated, but when an unknown *compound* is to be examined, the direct object of testing is to ascertain the several substances that make up the compound, and to arrive safely at this point it is necessary to make use of several tests, especially of those that are distinctive, if such are known, and to be had.

xii. There are two methods of doing this, and by the two conjointly, viz., by the blow pipe, and by re-agents, analytical investigations are successfully performed. I have combined both, and have endeavoured to attain the object in view as far as my means allowed.

xiii. I presuppose that those who may use the following compilation are acquainted generally with the proper methods of testing, and with the use of the blow-pipe. But those who are not I will briefly put in the way, premising only that the examples given are as plain and simple as I could make them; but not at all professing to go into the minute detail necessary when mineral or other substances are to be analized, and the quantities of their component parts are to be specified by weight.

xiv. Suppose an alkaline earth to be picked up, and you wished to know what it consisted of. The first step would be to dissolve it* in

* Or as much of it as is soluble.

pure water, stir it well, and filter. The clear liquid might then be thrown into clean test tubes, or wine glasses. If reddened litmus paper was dipped into one of them, and the liquid turned the paper blue, it would indicate the presence of a carbonated, or of a free alkali. To ascertain if carbonic acid was present, a little dilute nitric acid might be dropped into the same glass; should effervescence occur, it would establish the fact of carbonic acid being present; but if there was no effervescence, a free alkali may be assumed to be held in solution, and to have changed the colour of the paper.

xv. The solution might then be neutralized by nitric acid, and it would be known to be in that state when it affected neither blue nor reddened litmus paper; or it might be made a little acid. A drop of nitrate of silver might then be added, and if a white precipitate took place that blackened in the sun, and that was soluble in ammonia, it would indicate the presence of muriatic acid.

xvi. If a drop or two of oxalic acid, or oxalate of ammonia, were added to the liquid in another test tube, and a white colour or precipitate took place, it would indicate that lime was held in solution.

xvii. If another portion of the liquid was now concentrated by evaporation, and put aside to cool, perhaps crystals would shoot in it. If these crystals deflagrated when thrown on red hot charcoal, they would indicate that the earth contained saltpetre.

xviii. If the crystals were removed from this concentrated solution, when cold, and it was evaporated slowly to dryness, probably something like common salt would be seen to form. And if the taste in some measure corresponded therewith, it would, with the test of nitrate of silver, indicate that the earth was a saltpetre earth, mixed, as it usually is, with muriate of soda or common salt, and other substances.

xix. The earth that remained in the filter might be next examined—suppose dilute muriatic acid poured upon it dissolved a considerable portion with effervescence, leaving only a quantity of sand behind. If the acid solution gave a white precipitate with sulphuric acid, or oxalic acid, it might be presumed that the earthy part which was insoluble in water was chiefly carbonate of lime, and sand.

xx. I purposely abstain from going into niceties, because that would involve a dissertation: whereas, to ascertain the chief qualities of the earth is all that is here aimed at, or designed.

xxi. But as some further insight into the method of examining an unknown substance, may be desired by the young enquirer, I add the following directions from Rose, which I have re-arranged, and endeavoured to make plain and intelligible.

XXII. METHOD OF EXAMINING A MINERAL, OR COMPOUND SUBSTANCE, CONSISTING ONLY OF A BASE COMBINED WITH AN ACID; OR OF A METAL COMBINED WITH A NON-METALLIC BODY; ITS CONSTITUENTS BEING AMONG THE FOLLOWING SUBSTANCES.

BASES.

1 Potash
2 Soda
3 Ammonia
4 Barytes
5 Strontian
6 Lime
7 Magnesia
8 Alumina
9 Protoxide of manganese
10 Oxide of zinc
11 Oxide of cobalt
12 Oxide of nickel
13 Protoxide of iron
14 Peroxide of iron
15 Oxide of cadmium
16 Protoxide of lead
17 Oxide of bismuth
18 Deutoxide of copper
19 Oxide of silver
20 Protoxide of mercury
21 Peroxide of mercury
22 Oxide of gold
23 Protoxide of tin
24 Peroxide of tin
25 Protoxide of antimony

ACIDS, AND NON-METALLIC BODIES.

1 Sulphuric acid
2 Nitric acid
3 Phosphoric acid
4 Arsenic acid
5 Boracic acid
6 Carbonic acid

7 Chlorine
8 Fluorine
9 Sulphur
} combined with a metal of the above named bases.

TO DISCOVER THE BASE OR METAL.

XXIII. Reduce the mineral or substance to powder, and treat it first with distilled water, and the remainder with dilute muriatic acid, assisted by heat if necessary.* If it be a sulphuret, or if it contain silver, mercury, or lead, dilute nitric acid must be used instead of muriatic acid; for muriatic acid combines with silver, mercury, and lead, and produces an insoluble powder. The foregoing metals and bases may be dissolved by this process, but quartz, flint, silex, and such like hard stony matter cannot be, nor can the sulphates of barytes, strontian, lime, and lead.

* The water may be tested first, and afterwards the acid solution, or both may be mixed together.

xxiv. Provide a number of test tubes or other glasses: pour a little of the clear solution into each,* *the solution being made somewhat acid,* and proceed as follows. Each following letter, from *a* to *u* is supposed to be a distinct portion of the solution to be tested, in a different glass, or test tube.

First.—*Examination by means of water*† *fully saturated with sulphuretted Hydrogen.*

xxv. *a.* Add liquid sulphuretted hydrogen:‡ if no precipitate occurs, the base is included from No. 1 to 13.—If a precipitate takes place, the base is contained in from No. 14, to 25, and if the precipitate§ be white and milky, it is a proof that of all the before enumerated bases, peroxide of iron, alone, is present; but if it be black, the base is one of those from 16 to 22. These bases may be thus discriminated.

14. Perox: iron.
15. Ox: cadmium.
16 Protox: lead.
17. Ox: bismuth.
18. Deutox: copper.
19. Protox: silver.
20. Protox: mercury.
21. Perox: mercury.
22. Ox: gold.
23. Protox: tin.
24. Perox: tin.
25. Protox: antimony.

xxvi. *b.* Add ammonia: if the solution turn blue, the base is deutoxide of copper: or if the clean blade of a knife, or piece of clean iron be dipped into the solution, it will soon be coated with copper, if copper be present.

xxvii. *c.* Add a large quantity of water. If a milkiness occurs it indicates that the base is oxide of bismuth.‖

xxviii. *d.* If nitric acid, and not muriatic acid, has been used, add a drop or two of dilute muriatic acid; a white precipitate will indicate the presence of silver, or mercury. If it be silver, the addition of suffici-

* In many cases a mere drop of the solution upon a slip of glass may be tested, and the substance be ascertained from the indications given by the test.

† Distilled water is *always* intended whether specified or not.

‡ Arsenic is also precipitated by sulphuretted hydrogen, but the metallic oxides are precipitated sooner than arsenic, and may be separated from it by rapid filtration. The filtered solution, (which should smell strongly of sulphuretted hydrogen) may then be boiled and, if a yellow precipitate occurs, which is soluble in hydrosulphuret of ammonia, the presence of arsenic may be considered certain.

§ The word precipitate in its largest signification includes the idea simply of cloudiness or discolouration on the adding of a test. An *immediate* precipitate depends generally on the quantity, not on the quality, or nature, of a substance.

‖ Other tests in all these, and the following cases may be used, and ought to be, in order to verify the examination. Thus, on referring to the alphabetical list of tests, No. 41, bismuth, it will be seen, is discriminated before the blow pipe by fusing into a brittle globule that flies to pieces under the hammer; and if the substance examined is supposed to contain several bases, those tests should be selected which are absolutely discriminative of only one base if such can be found. For instance, clean iron discriminates copper beyond all doubt, and without liability of mistake. See 51 f. and 66.

ent ammonia will re-dissolve the precipitate; but if it be mercury, the ammonia will turn it black, or grey, but not dissolve it.

xxix. *e.* Add caustic potash in excess: if a yellow precipitate occurs, the base is peroxide of mercury.

xxx. *f.* Add sulphate of iron: should a brown precipitate be formed it may consist of metallic gold.*

xxxi. *g.* Add sulphuric acid, or the solution of a sulphate, if a white precipitate takes place the base is oxide of lead.

xxxii. If the precipitate formed by the liquid sulphuretted hydrogen is

Milk white....the	base is....	Peroxide of iron.
Dark brown....	do.	....Protoxide of tin.
Orange red......	do.	....Protoxide of antimony.
Yellow........	do.	....Peroxide of tin, or oxide

of cadmium, but to distinguish which of these last two bases is indicated, proceed as follows:

xxxiii. *h. Neutralize* the solution with ammonia, then add hydrosulphuret of ammonia, and if a yellow precipitate falls, which is not soluble in an excess of the hydrosulphuret of ammonia, the base is oxide of cadmium; but if the precipitate is easily dissolved in excess of hydrosulphuret of ammonia, then, the base is peroxide of tin.

xxxiv. This completes the examination of Nos. 14 to 25 for the base, or metal: but if peroxide of tin; protoxide of antimony, and arsenic acid, be all of them present in solution, it is difficult to discriminate these three substances with certainty, and to demonstrate their co-existence. Other tests must then be employed to corroborate and confirm the foregoing indications. See the several articles, antimony: arsenic: tin.

Second.—*Examination with Hydrosulphuret of Ammonia.*

xxxv. If the *acid* solution of the substance under examination gives no precipitate with liquid sulphuretted hydrogen, the base is not one of those just examined, viz. 14 to 25. Another portion of the solution should then be *neutralized* with ammonia, put into several other test tubes, and be proceeded with as follows:

xxxvi. *j.* If on adding hydrosulphuret of ammonia a precipitate is produced, the base is contained in from No. 8 to 13, and if the precipitate is black, the base is No. 11, 12, or 13. These three may be distinguished, one from the other, by the following experiment.

8. Alumina.
9. Protox: manganese.
10. Ox: zinc.
11. Ox: cobalt.
12. Ox: nickell.
13. Protox: iron.

* Gold is dissolved only by nitro-muriatic acid.

XXXVII. *k.* Add carbonate of potash, or of soda; if the precipitate is

First white, then green and finally brownish red at the surface.	the base is Protoxide of iron.
Dirty red..................	do. ...Oxide of cobalt.
Bright green................	do. ...Oxide of nickell.

XXXVIII. *l.* Add hydrosulphuret of ammonia: if a flesh-red precipitate occurs, the base is protoxide of manganese; but if it is white, the base will be either zinc, or alumina. They may be distinguished thus:

XXXIX. *m.* Supersaturate with caustic ammonia, and if the white precipitate re-dissolves on adding the ammonia, the base is oxide of zinc but if it does not, the base is alumina.

XL. *Note.*—If strontia, barytes, lime and magnesia be present in combination with phosphoric, or boracic acid, or when their metallic bases are combined with fluorine, they may also be precipitated by caustic ammonia. Phosphoric and boracic acid and fluorine ought not therefore to be present when ammonia is used, nor ought indeed magnesia by itself simply, for magnesia is also precipitated by caustic ammonia.

XLI. THIRD.—If the *acid* solution does not give a precipitate with liquid sulphuretted hydrogen; nor the *neutral* solution with hydrosulphuret of ammonia, the base is not included in Nos. 8 to 25, but in Nos. 1. to 7.

1 Potash.	5. Strontian.
2. Soda.	6. Lime.
3. Ammonia.	7. Magnesia.
4. Barytes.	

XLII. *n.* Add to the *neutral* solution, carbonate of potash. If a white precipitate occurs, the base is from No. 4 to 7. To discriminate which, observe that a white flocculent precipitate indicates magnesia: but if only after some time a precipitate is formed, the base is barytes. If no precipitate appears, the base is either lime or strontian.

XLIII. *o.* To distinguish between lime and strontian, dilute the *neutral* solution with a large quantity of water, and test with a few drops of sulphate of potash, or very dilute sulphuric acid. If a precipitate is *immediately* produced, the base is strontian; but if no immediate precipitate takes place, but after some time a crystalline precipitate appears, the base is lime.

XLIV. FOURTH.—If neither liquid sulphuretted hydrogen; hydrosulphuret of ammonia; nor carbonate of potash gives a precipitate, the substance must be from 1 to 3, that is, potash, soda, or ammonia.

XLV. *p.* To distinguish these; *concentrate* the solution. Add concentrated caustic potash, and hold over the liquid, a rod dipped in muriatic acid; if white clouds appear, the base is ammonia.

XLVI. *q.* Add to another portion of the *concentrated* solution, chloride

of platinum, if a yellow precipitate takes place, the base is potash: if no precipitate occurs, the base is soda.

XLVII. THE FOREGOING EXAMINATIONS HAVING DISPOSED OF THE BASES, AND METALS, INCLUDED IN THE LIST BEFORE ENUMERATED, THE FOLLOWING EXPERIMENTS ARE

TO DISCOVER THE ACID, OR NON-METALLIC BODY.

XLVIII. *r*. To the substance dissolved in water, or pounded and mixed with a little water, add muriatic acid; if effervescence occurs, accompanied with the well known odour of sulphuretted hydrogen gas, it indicates the presence of a sulphuret: but if the gas is in-odorous, it indicates carbonic acid in combination with some of the foregoing bases.

XLIX. To ascertain whether both carbonic acid and sulphur are present, provide a vial with a small glass tube bent twice at right angles. Place a portion of the pulverized substance in a vial and pour upon it dilute acid: place one leg of the tube in the vial and allow the gas to pass through the tube into another vial containing a solution of muriate of barytes, or lime water, to either of which a little ammonia has been added; let the other leg of the tube dip below the liquid in this second vial, and close both vials.* If a white precipitate takes place, which dissolves with effervescence in dilute acid, the substance contains carbonic acid. The sulphur will be recognized by the smell of sulphuretted hydrogen.

L. *s*. If muriatic acid produces no effervescence add to a *neutral* solution of the substance, muriate of barytes, and if a white precipitate takes place the presence of one of the acids in the margin is indicated. To ascertain which, proceed as follows:

Sulphuric, phosphoric,
Arsenic, boracic, fluoric.

LI. Add muriatic acid to the precipitate; if it remain unaltered, the acid is sulphuric: but if it dissolves, the following experiments must be made.

LII. Reduce a portion of the substance under examination to powder, and add thereto concentrated sulphuric acid, either in a leaden or a platina dish; prepare a piece of glass coated with wax, and trace any figure through the wax reaching to the glass. Warm the mixture gently, cover it with the glass, and if the glass after some time becomes corroded where the tracings were made, the substance proves to be a fluoride, i. e. containing fluoric acid.

LIII. If this effect does not occur, put a portion of the pulverized substance into a porcelain or platina capsule, and add a few drops of sul-

* It is necessary that the muriate of barytes, or lime water should be shielded from the atmosphere.

phuric acid. Then mix with it some alcohol, and inflame it: if a green flame is produced, the acid in combination is boracic acid.

LIV. *t*. If neither fluorine, nor boracic acid be present, add to the *acid* solution of the substance liquid sulphuretted hydrogen, and boil it: if a yellow precipitate is formed, soluble in hydrosulphuret of ammonia, it indicates arsenic acid.*

Carbonic acid, Sulphuric acid, Boracic acid, Arsenic acid, Phosphoric acid, Sulphur, Fluorine.

LV. *u*. When it has been ascertained that none of the foregoing substances are present, add to a portion of the substance dissolved in dilute nitric acid, nitrate of silver; and if a white precipitate is produced, which is not soluble in dilute nitric acid, but which is soluble in ammonia, then the substance contains chlorine in combination with one of the bases before enumerated.

LVI. Lastly, if none of the foregoing substances have been discovered throw a portion of the pulverized mineral on red hot charcoal. If lively combustion occurs, or if deflagration takes place, the acid in combination is nitric acid.

LVII. *Note*. As before observed, each paragraph beginning with a letter, i. e. from *a* to *u*, details a distinct experiment, which is to be performed with a fresh and distinct portion of the substance in solution, as directed; except the last experiment (LVI) in which the mineral or substance is to be pulverized.

OBSERVATIONS.

LVIII. The foregoing detailed experiments suppose that the nature of the substance is wholly unknown to the experimentalist; but whether it is partially known or not, he should assure himself of the accuracy of his determinations by other tests which he will find in the following pages.

LIX. In using the alphabetical list of tests, it will be frequently seen that several tests act on the metal, or substance to be tested. The learner may be at a loss which test to choose: but *in those cases where the test is distinctive, its indications are printed in italics;* by running the eye therefore over any article, *wherever the indications of the tests are seen printed in italics, those tests are to be preferred, as being those which may be most relied on.*

LX. When testing, it is desirable, in almost every case, to refer to the tables of tests at the end of this paper in order to ascertain at a glance how other tests affect the substance tested. This should never be neglected by the inexperienced.

* If neither sulphuric, arsenic, boracic nor fluoric acid is present, then the precipitate (L. *s*) must prove to be the only remaining acid, viz. the phosphoric.

LXI. It may lastly be mentioned, to prevent misconception by the young beginner, that in all cases, except where otherwise specified, the test, and the substance tested, is to be in the state of solution. And that, where neutralization is mentioned, he will remember that acids are neutralized by alkalies, and alkalies by acids. When a solution is neutralized it affects neither blue, nor reddened litmus papers; i. e. the solution, so neutralized, does not change the colour of either. Some *neutral salts* however affect litmus paper. See, Nos. 77 in the subsequent list of test.

LXII. ☞ It will be highly conducive to improvement, and to the acquisition of the most useful knowledge relative to the action of tests if the young experimentalist exercise himself in the examination of easy compounds made up by him of known combinations: for instance, let him mix a little common salt, and saltpetre together in solution, and test them for the bases, potash and soda; and for the acids muriatic, and nitric. Let him refer to those four articles in the list of tests, and endeavour, from the directions given, to ascertain both the bases, and the acids to his own satisfaction, and beyond doubt. He will learn more by this one experiment than by pages of printed directions not reduced to practice. Of course he is supposed to understand the modern nomenclature, and to be aware that common salt is muriate of soda; and that saltpetre is nitrate of potash: or, in other words, that common salt is muriatic acid in combination with soda, and that saltpetre is nitric acid in combination with potash. From this experiment he may proceed to others; and after he has attained some facility and skill, he may examine other combinations making them more complex and difficult, in proportion as his knowledge increases, and as he obtains more confidence and dexterity in qualitative examinations.

OBSERVATIONS ON THE BLOW PIPE.

LXIII. So also with regard to the use of the blow pipe, practice is the only efficient teacher: and the unpractised experimentalist should initiate himself by operating first on small fragments of known minerals and metals. A few concise observations here follow with respect to the examination of minerals.

LXIV. Take a minute chip of the mineral, and place it in a hollow made in a piece of well burned, hard, charcoal. Apply the blow-pipe, at first at the extremity of the flame where there is the least heat, and afterwards gradually at the point of the *blue* flame where there is the greatest heat. Observe the phenomena that occur, such as phosphorescence

ebullition, intumescence, vapours, odour, such as of sulphur, or garlic, the latter indicating arsenic, decrepitation, fusibility, colour, &c.

LXV. The same process and the same observation of phenomena should be repeated with fresh fragments of the mineral, fluxing them first with soda, then with borax, and lastly with microcosmic salt, the latter being a flux made of five parts of crystallized phosphate of soda and two parts of phosphate of ammonia. The indications produced by all these methods are given in a table at the end of this article; and by comparing the phenomena observed in his experiments with the indications specified in the table, the experimentalist in all ordinary cases will be able to identify the mineral or metal under examination.

LXVI. If the substance should decrepitate, it may be inclosed between two pieces of charcoal, and the flame be directed on it through a hole in the charcoal made for the purpose. In the case of earthy minerals, they may be wrapped in a piece of platina foil.

LXVII. All phenomena occuring upon the use of chemical tests, and appearances produced by the blow pipe, should be noted down immediately in a memorandum book in regular *methodical* order.

ANALYSIS OF MINERAL WATERS.*

LXVIII. The following observations may perhaps be useful in directing the student's attention to a few of the leading points in the examination of mineral waters.

LXIX. In examining a mineral water, it is of importance to ascertain its specific gravity, which gives some insight into the proportion of its saline ingredients. Mr. Kirwan (Essay on Mineral Waters, p. 145.) has given the following formula for calculating the proportion of saline substances in a water of known specific gravity: "subtract the specific gravity of pure water from that of the water examined, and multiply the remainder by 1.4. The product is equal to the saline contents in a quantity of the water denoted by the number employed to indicate the specific gravity of distilled water. Thus, suppose the specific gravity of the water = 1·079, and that of pure water = 1000 then 79. × 1.4 = 110.6 = saline contents in 1,000 of the mineral water." It is advisable to conjoin this method with the following:

LXX. Evaporate a given weight, say 1,000 parts, to dryness, and expose the residue for 24 hours to a temperature not exceeding 300

* From Brande.

upon a platinum capsule; weigh it while warm, and the mean obtained from this and the former experiment will give the proportion of dry saline ingredients within a trifling error. Thus suppose 1000 parts of the above mentioned water give by evaporation 114·4 dry residue, then 110.6 + 114·4 = 225 ÷ 2 = 112.5 = quantity of saline matter in a dry state (salts deprived of water of crystallization) existing in the water.

Having ascertained the relative quantity of foreign matter in the water, the nature of the substances present is next to be inquired into. The substances which have been found in mineral waters are extremely numerous, those which very ordinarily occur are the following:—Oxygen, nitrogen, carbonic acid, sulphuretted hydrogen, carbonate of lime, carbonate of magnesia, carbonate of iron, muriate of magnesia, chloride of sodium, sulphate of magnesia, sulphate of soda, and sulphate of lime.

LXXI. Oxygen and nitrogen exist in the greater number of spring-waters in the proportions constituting atmospheric air; the proportion of nitrogen is, however, not unfrequently predominant. These gases give no peculiar flavour to the water.

LXXII. Carbonic acid renders waters sparkling and effervescent: it is detected by occasioning a precipitate in aqueous solution of baryta, which dissolves with effervescence in dilute muriatic acid.

LXXIII. The presence of sulphuretted hydrogen is known by its odour, by the production of a black precipitate, on dropping into the water a solution of nitrate of silver; and by the deposition of sulphur, on adding a few drops of nitric acid.

LXXIV. The carbonates are dissolved in the water by excess of carbonic acid, and consequently fall upon its expulsion by boiling. Carbonate of lime and magnesia are deposited in the form of a white precipitate. Carbonate of iron occasions the separation of a brown powder, and the water is blackened by a few drops of tincture of galls.

LXXV. Mr. Phillips, in his analysis of Bath-waters, has shown that the delicacy of galls, as a test for iron, is affected by the presence of certain salts: if the iron be in the state of protoxide, its detection is facilitated by salts with a base of lime, and by alkalies; if in the state of peroxide, lime prevents the action of the test. This is well shown by dissolving a very minute portion of protosulphate of iron in a glass of distilled water, and adding a drop of tincture of galls, which occasions no immediate discoloration; but a drop of lime water, or other alkali, instantly renders the presence of iron evident; so that the quantity of iron present in a water cannot be correctly judged of by the degree of precipitation occasioned in it by tincture of galls.

LXXVI. Ferrocyanuret of potassium is also a good test to show minute quantities of iron in water, by the blue precipitate which it occasions; its action is aided by previously adding two or three drops of nitric acid to the water; but it is an equivocal test compared with galls.

LXXVII. The presence of chlorides or muriatic salts is indicated on adding sulphate of silver by a white cloud, insoluble in nitric acid.

LXXVIII. The sulphates, when present in water, afford a white precipitate on the addition of nitrate of baryta, which is insoluble in nitric acid.

LXXIX. Lime is recognised by a white cloud on dropping oxalate of ammonia into the water. A portion of the precipitate collected upon leaf-platinum, and heated before the blow-pipe, may be burned into quick lime.

LXXX. Magnesia is rendered evident by adding carbonate of ammonia, which throws down the lime, and subsequently dropping in phosphate of soda, which, when magnesia is present, carries it down in the form of a granular precipitate of ammoniaco-magnesian phosphate.

LXXXI. Such are the readiest means of recognising the presence of the various substances that commonly occur, by the action of re-agents or tests; and, having gained such general information, we next proceed to the analysis of the water, in order to ascertain the relative proportions of the gaseous and saline ingredients which it holds dissolved.

LXXXII. To ascertain the relative proportions of the gaseous contents of water with perfect accuracy, is difficult, and rarely necessary; the following method is sufficiently precise in all ordinary cases. Provide a florence flask capable of holding rather more than a measured wine pint, which quantity of the water under examination is to be introduced into it, and a cork carefully fitted to its neck, having a perforation, in which is inserted a glass tube one-eighth of an inch in diameter, rising perpendicularly about eighteen inches, and then bent so as to pass conveniently under the shelf of the mercurio, pneumatic apparatus. (Where a sufficiency of mercury cannot be procured, warm water may be substituted, if only carbonic acid be present, and it may be absorbed by transferring the jar containing it to a solution of potassa). The flask should be placed over an argand lamp, and heat gradually applied till the water fully boils. The gas evolved is to be collected in the usual way, in a graduated jar over quicksilver, and submitted to the following examination.

LXXIII. Throw up a small quantity of solution of potassa, which, if carbonic acid be present, will absorb it, and the quantity will be shown by the diminution of bulk.

LXXXIV. Introduce the remaining air, or a portion of it, into a small bent tube, containing a bit of phosphorus; heat it so as to kindle the phosphorus, and note the diminution of bulk when cold. It is proportional to the oxygen present, and, if equal to one-fifth of the whole bulk, the gas may be regarded as atmospheric air.

LXXXV. If sulphuretted hydrogen be present it may be separated by alcoholic solution of iodine, which absorbs it, and scarcely takes up more than its own volume of carbonic acid gas. Chlorine, added to a mixture of sulphuretted hydrogen and carbonic acid, will also produce the absorption of the former, if a little water be present; but it cannot be conveniently used over mercury.

LXXXVI. During the ebullition it not unfrequently happens that a precipitation ensues, indicating that the substances thrown down were dissolved by carbonic acid; and in that case they should be separated upon a filter, (*a*) after which the remaining water may be evaporated to dryness in a glazed porcelain basin; the dry residue must be transferred to a silver, capsule and perfectly desiccated at a temperature not exceeding 500° (*b*).

LXXXVII. The precipitate (*a*) may consist of carbonate of lime, of carbonate of magnesia, or of oxide of iron; or it may be a mixture of the three. Dissolve it in dilute muriatic acid, and add oxalic acid, which throws down oxalate of lime; separate this by filtration, and saturate the filtrated portion with carbonate of ammonia, which precipitates the peroxide of iron, and having removed this, evaporate the residuary mixture, and expose the dry salt to a red heat in a small platinum capsule; the magnesia, if any were present, will remain; if not, there will be no residue; for the oxalic acid and muriate of ammonia will be destroyed and volatilized.

LXXXVIII. When carbonic acid holds iron in solution, the metal is in the state of protoxide, and if air be excluded, it requires long boiling to decompose it; for the same reason, if the water be exposed under the exhausted receiver of the air-pump, it does not readily become brown, as is the case when it is exposed to air; a drop or two of nitric acid facilitates the deposition of the red oxide.

LXXXIX. The dry residue (*b*) is to be digested in six or eight parts of boiling anhydrous alcohol, which will take up muriate of magnesia, and in some rare cases (where no sulphates are present) muriate of lime. Filter off the alcoholic solution, and wash the residue (*c*) with a little fresh alcohol, which add to the former, and evaporate to dryness, the dry mass (*d*) exposed for some time to a heat of 500,° is generally pure muriate of magnesia: if it contain muriate of lime, the latter earth may be separated by solution of oxalic acid, in the state of oxalate of lime.

XC. It is, in some cases, convenient to convert the muriates of lime, and magnesia into sulphates, by pouring upon them excess of sulphuric acid, evaporating to dryness, and heating the dry mass red hot. The sulphate of magnesia may then be almost completely separated from the sulphate of lime, by a small quantity of cold water; or a saturated solution of sulphate of lime may be used, which takes up the sulphate of magnesia, and leaves the sulphate of lime.

XCI. The residue (*c*) insoluble in alcohol, may contain chloride of sodium, sulphate of soda, sulphate of magnesia, and sulphate of lime; digest it in ten parts of boiling distilled water, which, when cold, will have taken up every thing but sulphate of lime, of which an inappreciable portion only will have been dissolved; separate the solution into two equal portions, A and B: which may afterwards be further diluted.

XCII. To A add nitrate of silver, and wash and dry the precipitate, which is chloride of silver, 146 parts indicate 60 of chloride of sodium.

XCIII. To B add acetate of baryta as long as it occasions a precipitate, which is sulphate of baryta, (e) and which is to be separated, dried, and weighed. 117 grains are equivalent to 72 of dry sulphate of soda and 60 of dry sulphate of magnesia.

XCIV. In order to ascertain the quantity of magnesia present, and consequently the quantity of sulphuric acid belonging to it, evaporate the liquid filtered off the barytic precipitate (*e*) to dryness; it will contain chloride of sodium, acetate of soda, acetate of magnesia, and, probably, a portion of the added acetate of baryta; ignite the dry mass, and wash it to separate the chloride of sodium and the soda; magnesia and carbonate of baryta will remain insoluble, upon which pour dilute sulphuric acid; digest, filter, and evaporate the clear liquor to dryness; it is sulphate of magnesia, equivalent of course to the original portion of the salt; deduct the sulphuric acid contained in it from the whole in the precipitate (*e*), and the remainder will give the quantity united to the soda.

XCV. To estimate the quantity of sulphate of lime in the water, the residue of the evaporation of one pint may be washed with cold saturated solution of sulphate of lime, which, in most cases, will dissolve every thing but that sulphate, and which may thus be obtained and weighed; or, add oxalate of ammonia to a given quantity of the boiled and filtered water, collect the precipitate, and give it a red-heat with excess of sulphuric acid, by which it is converted into sulphate of lime, equivalent to the original in the water.

XCVI. Besides the substances now enumerated, and which may be

considered as the most frequently occuring ingredients in mineral waters, the following are occasionally present.

xcvii. *Carbonate of soda* is known to exist in water, when, after having been boiled down to half its bulk, and, if necessary, filtered, it reddens turmeric paper, and restores the blue of litmus reddened by vinegar; it also affords an effervescent precipitate with nitrate of baryta, soluble in dilute nitric acid. This carbonate is incompatible with the soluble salts of lime.

xcviii. *Muriate of lime* may also be used to detect the alkaline carbonates, with which it affords a precipitate of carbonate of lime. Carbonate of soda is distinguished from that of potassa, by the latter affording a precipitate in neutral muriate of platinum, which the former does not. Carbonate of ammonia is discoverable by its smell, when acted on by caustic fixed alkali or lime: also by its action on test-papers.

xcix. *Silica* is detected by evaporating the water to dryness, and boiling the residue in dilute muriatic acid. The silica, if present, remains as a white powder not altered by a red-heat, but instantly fusing with a particle of carbonate of soda.

c. *Boracic acid and borax* have been found in certain lakes in India, and in some parts of Italy. To detect boracic acid, evaporate to one-eighth the original bulk of the water, and add carbonate of soda as long as it occasions any precipitate; boil and filter. The filtered liquor will contain borate of soda with some other salts of the same basis; evaporate to dryness in a platinum crucible, and digest the residue in three or four parts of sulphuric acid, diluted with its bulk of water. If boracic acid be present, it will separate in micaceous crystals.

ci. *Alumina* has been found in a few mineral waters in the state of a sulphate. It may be separated by the following process: evaporate to dryness, digest in alcohol, and redissolve the residue in eight parts of water; filter and add oxalic acid, which throws down lime, and which, being separated, leaves magnesia and alumina in solution. Carbonate of ammonia throws down the alumina and leaves the magnesia.

cii. Pure ammonia throws down both alumina and magnesia. These earths may be separated by solution of potassa which dissolves the former but not the latter.

ciii. *Manganese* is sometimes found in water, but only in very small proportion, so as not to amount to more than a trace. Dr. Scudamore found a trace of Manganese in the waters of Tunbridge Wells, and it has never been discovered in larger proportion.

CIV. Certain *nitrates* are occasionally present in water. Nitrate of lime will be taken up from the residue of evaporation by alcohol, and may be decomposed by carbonate of potassa, so as to afford carbonate of lime and crystals of nitre.

CV. It sometimes happens that water contains *lead,* which may be detected by evaporation to one-eighth its bulk, adding a few drops of nitric acid, and then sulphate of soda, which gives a white insoluble precipitate; and sulphuretted hydrogen, which forms a black cloud. These precipitates may be reduced by heating them before the blow-pipe upon charcoal, mixed with a little black flux.

CVI. If *vegetable* or *animal matter* be contained in water, it gives it a brown colour, especially when evaporated. It may be destroyed in the dry residue by igniting it with a small addition of nitrate of ammonia.

CVII. *Iodine* and *Bromine* must always be sought for in mineral waters. Where they are suspected, the water should be evaporated to dryness, and the residue triturated with a little distilled water, which will take up the iodic and bromic salts, they are recognized by the addition of a solution of starch, having previously added a few drops of solution of chlorine; the iodine will turn blue, but if no iodine be present the chlorine will turn the bromine of a yellow tint.

A DICTIONARY

OR ALPHABETICAL LIST OF

CHEMICAL TESTS, AND RE-AGENTS.

1. **ACID** *acetic,* detects resin and gluten which dissolve in it, but on the addition of water the resin precipitates: the gluten does not. See 103. Acetic acid dissolves camphor, and essential oils; and combines with earths, alkalies and metals, forming the class of salts, called acetates. *These salts are decomposed by strong sulphuric acid, which liberates the acetic acid, when the latter may be detected by its well known odour, which is that of strong vinegar,* see 18 *a.*

a Acetic acid may be contaminated by sulphureous and sulphuric acids; they may be discovered by their proper tests, see 40, and 70 *a.*

2. **Acid** *arsenious*, the white arsenic of the shops, detects and is detected by hydrosulphurets, and sulphuretted hydrogen gas, with which it produces a yellow precipitate. The liquid contained in the stomach of a rabbit poisoned with three grains of arsenious acid, afforded a white precipitate with nitrate of silver, greyish-white with lime water, green with the ammonia-sulphate, and deep yellow with sulphuretted hydrogen water, see 39.

a When a particle of arsenic is sublimated between two plates of glass, it forms nebulous patches, considerably like those formed by sulphur, sublimated in the same manner, but the microscope makes a great distinction between them. The sulphur is globular or semi-globular; the arsenic is crystallized: this method might be used as an auxiliary in detecting small quantities of arsenic, see 39.

3. **Acid** *boracic, is indicated by its characteristic green flame when a solution of it in alcohol is set on fire.* To distinguish a borate from other salts, digest it in sulphuric acid slightly in excess, evaporate to dryness, and digest the residue in alcohol, which dissolves the boracic acid set free by the sulphuric acid, and its presence is then indicated as above. Boracic acid turns turmeric paper brown; it has but a slight action on litmus paper.

4. **Acid** *carbonic*, is detected by barytes, see 40 *e*. By litmus, see 77. By lime water, see 75; By sulphate of iron, see 67 *b*. and *by the mineral acids which drive it off, or set it free with effervescence*, see 11 *e*, 13 *g*, and 18 *g*. Carbonic acid detects lime in solution, precipitating it as carbonate of lime. Carbonates may be easily distinguished from other salts, by their effervescing without smell, on the addition of a mineral acid; see 45 ☞.

5. **Acid** *chloric, or hydro-chloric*, see 11.

6. **Acid** *chromic*, see 48.

7. **Acid** *fluoric*, see 18 *a*, and 54.

8. **Acid** *gallic, detects iron in solution, forming ink.* The solution should be of the per-oxide of iron for the test to act immediately, see 55. Gallic acid may be distinguished from tannin by producing no precipitate when added to a solution of gelatine.

9. ACID *hydriodic. This acid, or any of the hydriodates may be detected by adding thereto sulphuric, or nitric acid, or chlorine, which sets the iodine free; the iodine may then be recognized by its blue colour.* The best way of testing is to add starch to the solution, and afterwards a drop or two of strong sulphuric acid, which will produce the characteristic blue colour, if iodine be present. If liquid chlorine be employed it must not be added in excess, for if it is, it destroys the blue colour, and becomes a fallacious test. Chlorine gas may be thrown on the surface of the liquid, and be thus used successfully, producing the same blue appearance, see 63 and 113.

a Hydriodate of potass or iodine is acted on by several tests; but none are so distinctive as the foregoing. Corrosive sublimate forms a fine carmine red precipitate of the bin-iodide of mercury. Acetate of lead thrown down a fine yellow precipitate of the iodide of lead. Protonitrate of mercury precipitates protiodide of mercury, which is a yellow powder that fades gradually into a dirty brown. Muriate of platinum produces a brown precipitate of iodide of platinum.

10. ACID *hydro-cyanic,* or *Prussic acid may be known in its free state by the similarity of its smell to the odour of peach-blossoms.* But if the acid is strong, great care should be taken, not to smell it too hastily; as it is deadly poisonous. To detect it in solution, add first protosulphate of iron, and then pure potass slightly in excess, which will precipitate the protoxide of iron. Let the whole be exposed to the air for five or six minutes, and then add sufficient muriatic, or sulphuric acid to re-dissolve the precipitate; and if hydro-cyanic acid be present, there will be a formation of prussian blue. Nitrate of silver is also a test for prussic acid, see 108, *b.*

a To ascertain the strength of a solution of this acid, precipitate with nitrate of silver, and dry the precipitate. 100 parts correspond with 20.33 of pure hydrocyanic acid.

b. Both the bitter almond, and the cherry laurel, as well as the flowers and kernels of some fruits, contain more or less of this violently poisonous acid.

11. ACID *muriatic, chloric* or *hydro-chloric.* These three names may be considered as synonymes for the same acid. Muriatic acid detects (*a*) silver; (*b*) lead; (*c*) manganese; (*d*) ammonia; (*e*) carbonic acid. Muriatic acid is detected by sulphuric acid and other tests, see 18, 47, and 108.

a. Muriatic acid detects and is detected by solution of silver, by a copious white precipitate of the muriate or chloride of silver; which is

soluble in ammonia, insoluble in dilute nitric acid, and which blackens in the sun, see 47, 106.

b. Lead, by a white precipitate, which is not soluble in ammonia, but which is soluble in nitric acid, see 69.

c. Manganese, by the disengagement of chlorine gas. Melt soda, or borax in a platina spoon, add a little manganese, or ore containing manganese, and a red colour will appear on keeping the spoon in the interior flame of a candle, but it gradually disappears; add nitre and place the spoon in the exterior flame and the red colour again becomes visible, which confirms the test, see 81.

(*d*) Ammonia, by dense white clouds, thus; dip a rod in muriatic acid, and if free ammonia be present, on holding the rod over the substance to be examined, dense white clouds of muriate of ammonia will be seen to form, see 27, and 28.

(*e*) Carbonic acid, by the effervescence produced on adding muriatic acid to either a mineral, or a solution in which carbonic acid is present.

(*f*) Pure muriatic acid is colourless, but it frequently contains iron or chlorine which may be known by its being then of a yellow colour. It may also contain sulphuric acid. Both the iron and the sulphuric acid, may be detected by their proper tests, see 55 and 40.

(*g*) The specific gravity of muriatic acid should be 1·170, but that of commerce is generally from 1·156, to 1·160.

12. **ACID** *meconic.* This acid yields a red colour with the persalts of iron, and an emerald green with the sulphate of copper. By these tests the presence of opium may be discoverd.

(*a*) M. Couerbe gives the following table of the colours produced by agitating the peculiar substances contained in opium with sulphuric acid and air. The experiment is to be made in a four ounce vial with six grains of the substance, and nearly half an ounce of sulphuric acid mixed with a little nitric acid. Strong agitation is to be employed and the colour is developed in a few minutes.

Sulphuric acid mixed with a little nitric acid.		*Pure Sulphuric acid.*	
Thebaia.	Instantly red, becoming deeper.	Thebaia.	Rose colour, shade of yellow.
Narcotina.	Yellow, turning red.	Narcotina.	Blood red.
Codeia.	Very pale green.	Codeia	Green.
Morphia.	Green, almost immediately.	Morphia.	Brown.
Meconin.	In 24 hours superb rose colour.	Meconin.	Turmeric yellow; afterwards red.
Narceia.	Mahogany colour.	Narceia.	Chocolate colour.

b. Morphia and its salts, form a deep greenish blue solution with permuriate of iron; and turn brown on adding a drop or two of iodic acid. The proper solvents of morphia are alcohol, and diluted acids. Nitric acid turns it orange red, or if much acid is used, yellow, all the salts of morphia are intensely bitter, see *f.*

c. Narcotine is distinguished rather by negative than positive chemical properties. If *pure* it is not affected by permuriate of iron, nor nitric acid. When morphia and narcotine are crystallized together in an alcoholic solution, and when they are not quite pure, the narcotine forms tufts of pearly thin tabular crystals, while the morphia is in short thick adamantine prismatic crystals.

d. Codeine differs from morphia and narcotine in being moderately soluble in water and from this solution it may be obtained in large crystals tending to the form of octahedrons.

e. In cases of poisoning by tincture of opium, it is difficult to detect it, if it has lain in the stomach a few hours.

f. A mixture of equal parts of strong aqua-ammonia, and alcohol will produce in laudanum a crystalline precipitate of morphia in a few hours. This precipitate of morphia may by being twice dissolved in acetic acid, and twice precipitated by ammonia be obtained quite white.

12. ACID *nitric,* detects (*a*) resin; (*b*) starch; (*c*) nitrogen; (*d*) uric acid; (*e*) iron from steel; (*f*) tin; (*g*) carbonic acid.

a. Resin. When concentrated nitric acid is digested repeatedly with gum, mucilage, gluten, jelly, extract, gum-resin, or other immediate vegetable product, it is partly converted into oxalic acid, but resin is not. The resin results as a pale orange coloured mass, soluble in water, but possessing no resinous properties, see 1 and 103.

b. Starch. If a vegetable substance is digested for some days in dilute nitric acid; on the addition of alcohol, starch will be precipitated if present, see 113 *a.*

c. Nitrogen. This gas is set at liberty when animal matter is digested with nitric acid.

d. Uric acid is detected in the analysis of urine by a pink or rose colour on the addition of nitric acid. If a little of the solution containing the nitric acid be evaporated to dryness in a watch glass over a spirit lamp, a beautiful purple colour is produced, which is improved by the addition of water.

e. Dilute nitric acid dropt on iron produces a grey spot, but on steel, a black spot, see 114

f. Tin is precipitated by nitric acid in the state of pure oxide.

g. Carbonic acid is liberated with effervescence by nitric acid, in the same manner as by muriatic, or sulphuric acid. See 11 *e*, and 18 *g*.

14. ACID *nitric* detected. *If a solution contain nitric acid free or in combination with a base, it will not by itself dissolve gold leaf, but on the addition of muriatic acid the gold will be dissolved, nitro-muriatic acid being formed. Morphia turns nitric acid of a beautiful orange red colour. Nitrate salts deflagrate when thrown on red-hot charcoal.* Nitrates are also detected by sulphuric acid, see 18 *a*. Strong sulphuric acid and copper filings being put into a test tube with a nitrate salt, the acid will be detected by the disengagement of orange-yellow vapours.

a. Nitric acid should be as limpid as water and be kept in a dark place to prevent its conversion into the nitrous kind. It may be adulterated with sulphuric, or muriatic acid, either of which may be detected by the proper tests: see 40, and 108.

b. Concentrated nitric acid has a specific gravity of 1·500, but it is seldom found so heavy.

15. ACID *oxalic*, detects lime producing a white precipitate of oxalate of lime. See 35,44,72. See 35 for precautions in using the test of oxalic acid for lime. Many of the metals are acted on by this test; see table of re-agents. If nitrate of silver be dropped into a solution of oxalic acid, a white precipitate of oxalate of silver occurs, which being collected on a filter, dried, and heated, first becomes brown on the edges, then fulminates and is dispersed.

a. Oxalic acid oxidizes lead, copper, iron, tin, bismuth, nickel, cobalt, zinc and manganese. It also combines with alkalies, earths, and metallic oxides and forms salts known by the name of oxalates.

b. Oxalic acid is detected by muriate (or hydrochlorate) of lime, producing a white precipitate of oxalate of lime, soluble in nitric acid; which distinguishes it from sulphate of lime. On the other hand oxalate of lime is not soluble in a *small* quantity of muriatic acid, and this distinguishes it from the tartrate, citrate, carbonate and phosphate of lime. Sulphate of copper gives a faint bluish white or greenish white precipitate of oxalate of copper, not soluble in a small, but soluble in a large quantity of muriatic acid. Its insolubility upon adding a few drops only of muriatic acid distinguishes it from the carbonate and phosphate of copper. Nitrate of silver produces a detonating precipitate as before mentioned, which is a good distinctive test of oxalic acid. The citrate and tartrate of silver become brown and froth up, and the

former deflagrates on applying sufficient heat, but neither of them fulminates like the oxalate of silver.

16. **ACID** *prussic*; see 10.

17. **ACID** *phosphoric* is detected by proto-nitrate of mercury which produces a precipitate of phosphate of mercury; by acetate of lead which gives a white precipitate; and by nitrate of silver which yields a yellow precipitate. All these precipitates are soluble in nitric acid. No alkali, or alkaline earth should be present, see 83 *e*. The detection of phosphoric acid is frequently attended with difficulty.

a. Solutions of the neutral phosphates of alkalies produce precipitates with the muriates of barytes, and lime; and with lime water and barytes water. These precipitates are soluble in muriatic and nitric acids; and in solutions of ammoniacal salts.

18. **ACID** *sulphuric*, (see 116) detects (*a*). The acids in combination with salts; (*b*), barytes; (*c*), strontian; (*d*), lime; (*e*), lead; (*f*), mercury; (*g*), carbonic acid; (*h*) vegetable or carbonaceous matter.

a. The salt to be examined should be in the solid state or nearly so: it is to be pounded and covered with sulphuric acid, and heat is then to be employed. If the salt is a *nitrate*, the nitric acid will be evolved in white vapours without effervescence, and if copper filings be added, red vapours accompanied with effervescence will be disengaged. See 14. If the salt be a *muriate*, the muriatic acid will be driven off in white vapours, which will form a dense white cloud round a rod held in them, if it be first dipped in ammonia. See 11 *d*, 28 *b*. *Acetic acid* will be discovered by the vapours smelling like vinegar, see 1. *Fluoric acid* is driven off in poisonous fumes, which must not be inhaled, and which corrode glass if it be held in or over them for a few minutes, see 54. The whole of the foregoing indications may be confirmed by other tests.

b. Baryta detects and is detected by sulphuric acid either free, or in combination, as in the state of sulphates, by the production of a white precipitate, see 40, and 115 *e*.

c. Strontia is affected in the same manner as barytes, see 40, and 115.

d. Lime is detected by sulphuric acid, but the solution should be concentrated,—oxalate of ammonia is a better test for lime, see 35, 44, 72.

e. Lead gives a white precipitate of sulphate of lead, when tested with sulphuric acid, see 69.

f. Mercury also gives a white precipitate with sulphuric acid, which becomes yellow when boiled. But there are other more useful tests for mercury, see 82.

g. Carbonic acid is discovered by its effervescence on adding sulphuric acid, in the same manner as before mentioned under the head of muriatic acid.

h. When water containing vegetable or carbonaceous matter is evaporated after adding sulphuric acid, it acquires a distinct brown colour, which becomes deeper as the liquid becomes more concentrated.

19. ACID *tartaric* distinguishes potash from soda. The solution must be concentrated, and the tartaric acid be added in excess. With potash it produces a precipitate of bi-tartrate of potash, or cream of tartar; with soda it produces no precipitate.

a. To detect tartaric acid ; add to a solution which must be concentrated an excess of lime water, and a precipitate will be formed which is soluble in a small quantity of ammonia :—*or add carbonate of potash which will precipitate tartrate of potash, or cream of tartar.*

20. ACID *uric*, see 13, *d* for its detection.

21. ACIDS *free, are detected by litmus or turmeric paper, or by tinctures or solutions of litmus and turmeric;* but the litmus test is not universally distinctive, see 77. Acids in combination with salts and other bases, are discovered by a variety of tests, see all the foregoing articles.

22. ALBUMEN is detected by the per-muriate of mercury, see 53. It is also indicated by the muriates of gold, and tin ; by sub-acetate of lead, and nitrate of silver ; but these tests are not decisive, as they are affected by other substances, see 87. When a liquid containing albumen is submitted to galvanism (which is considered a most delicate test) it coagulates on the wire connected with the positive pole of the battery, and pure soda is found at the negative wire.

a. The precipitate by the per-chloride of mercury is soluble in acetic acid, and is not altered by boiling. Sulphate of copper added to the solution produces a green, and chloride of iron, a yellowish-brown precipitate.

b. An excess of sulphate of copper completely precipitates albumen of a green colour, which is dissolved by an excess of albumen. Ammonia dissolves this precipitate forming a dark blue solution. Potash produces a violet solution. A solution of carbonate of soda dissolves it completely, occasioning a violet colour. Potash throws down the copper, but in the filtered liquor, no sulphuric acid can be detected. The

precipitate consists of albumen and protoxide of copper; the per centage of the oxide being about 1·65.

c. Albumen is not precipitated by phosphoric nor by acetic acid.

d. If water containing $\frac{1}{1000}$ of its weight of albumen be boiled, it will be rendered perceptibly opaque. This is a distinguishing characteristic, and sufficiently delicate for practical purposes.

e. Ferrocyanate of potash is a delicate test also, but a slight excess of acetic acid should be previously added.

23. ALCOHOL is useful in analysis, and for making tinctures. Its strength is known by its specific gravity, which in the strongest is about 0.800. It detects the adulteration of volatile or essential oils with fixed oils, thus; mix a few drops of oil of almonds, or of olives, with any essential oil, say oil of lavender, and pour alcohol on the mixture; the essential oil will dissolve in the spirit, but the fixed oil will not. Pour off the alcholic solution, and add thereto distilled water; the water will unite with the alcohol, and set the essential oil at liberty, which may be thus obtained pure and freed from the adulterated oil. See 73 regarding the action of alcohol with acids, and æthers.

a. Alcohol dissolves soap, vegetable extract, sugar, oxalic, camphoric, tartaric, gallic and benzoic acids, volatile oils, resins, balsams; fixed oils it dissolves but sparingly except castor oil which it dissolves in considerable quantity. It combines with sulphur, phosphorous, and the pure alkalies, but not with their carbonates, nor when pure with any of the earths. Some salts in solution particularly sulphates are precipitated on the addition of alcohol; by this means salts insoluble in alcohol are sometimes separated in chemical analysis.

b. When alcohol is set on fire, mingled with boracic acid, the flame is green; with nitre, common salt, and the salts of barytes the flame is yellow: with strontia, rose-red; with salts of copper, a greenish hue; and a red colour with the salts of lime and lithia.

24. ALKALIES *and their carbonates*, may be *detected by litmus paper*, see 78. Potash is distinguished from soda by the tests, Nos. 19.97.110. Alkalies and their carbonates act on almost all the metals, so that they are not discriminative tests, but are useful auxiliaries. See table of re-agents.

25. ALUMINA, *muriate of*, detects carbonate of magnesia in solution. If an alkali be present it must first be neutralized.

26. ALUMINA if pure is white, but is often yellowish and horny when obtained by gently drying the hydrate of alumina. It is insoluble in water, but soluble in acids if it has not been ignited. After ignition it is best dissolved by digestion in concentrated muriatic acid, diluted

with a very small proportion of water—no free acid produces a precipitate in aluminous salts.

Potash produces in neutral solutions a bulky precipitate of the hydrate of alumina soluble in excess of the potash. Muriate of ammonia (if the precipitate be re-dissolved by the potash) produces in such solution a precipitate of alumina.

Ammonia gives a voluminous precipitate insoluble in an excess of the ammonia. The presence of muriate of ammonia does not prevent the production of this precipitate, (see 34) nor yet of the precipitates by the following re-agents, on which account salts of alumina cannot be mistaken for those of magnesia.

Carbonate of potash.... *Carbonate of ammonia* *Phosphate of soda ....*	A voluminous precipitate soluble in acids, and in a solution of potash.

Oxalic acid, neutral oxalates, prussiate of potash, tartaric acid, liquid sulphuretted hydrogen, and *sulphuretted hydrogen gas* produce no precipitates.

Hydrosulphuret of ammonia produces a precipitate of pure alumina and so does muriate of ammonia, see 34 and 36.

a. Aluminous minerals before the blow-pipe on charcoal produce a blue flame if moistened with nitrate of cobalt.

b. Salts of alumina are distinguished by a sweet astringent taste. They are not precipitated by oxalate of ammonia, nor tartaric acid, which distinguishes them from salts of yttria ; nor by tincture of galls, or prussiate of potash, in which they differ from the salts of yttria and of glucina. If sulphuric acid, and then sulphate of potash be dropped into a solution of alumina, or its salts, and the liquid be allowed to repose, crystals of alum soon make their appearance.

c. Solutions of alumina are distinguished from those of alkaline salts by producing a white precipitate with ammonia : from solutions, of barytes, stronia, and lime by a white precipitate with ammonia, and no precipitate with sulphuric acid which produces a precipitate in those earths except in the case of dilute solutions of lime. Alumina is distinguished from magnesia in solution by its behaviour with potash, and muriate of ammonia. In neutral aluminous solutions, potash produces a bulky precipitate, which wholly re-dissolves in an excess of potash ; and in such a solution of alumina in potash, muriate of ammonia produces a precipitate of alumina. Distinguished from glucina, see 57, *a.*

d. The hydrate requires very careful washing and long continued heat in drying for quantitative analysis.

27. **AMMONIA,** detects copper, turning the solution blue. Ammonia acts on a great number of the metals. See table of re-agents. *It is detected by muriatic acid,* see 11, *d.* Pure liquid ammonia is liable to attract carbonic acid from the atmosphere, but this acid may be detected by baryta, see 40, or lime water, see 75.

a. Ammonia is acted on by a spirituous solution of chloride of platinum, and by sulphate of alumina in the same manner as potash is, namely, the former produces a bright yellow precipitate, and the latter produces crystals of alum, if the solution be acid, and concentrated. Tartaric acid produces in concentrated solutions of ammonia a crystalline precipitate of bitartrate of ammonia. Hydrofluosilicic acid precipitates its own silica in solutions of ammonia, but it must not be added to saturation, the ammonia must be in excess, otherwise no precipitate is produced.

b. When dry ammoniacal salts or concentrated solutions of them; and caustic or carbonated alkalies, or earths are triturated together, an immediate odour of ammonia escapes; and the presence of ammonia is infallibly detected by presenting to the mass, or the liquid, a rod dipped in rather strong, but not fuming muriatic acid.

c. It is of the greatest importance to be aware of the remarkable property possessed by ammonia of forming triple salts with earths and metallic oxides, as is the case when the sulphates of magnesia, lime, and iron, occur together.

d. If a mineral water contain free carbonic acid, or carbonate of magnesia, and carbonate of lime, the addition of ammonia will take up part of the carbonic acid, and the carbonate of ammonia thus formed will throw down carbonate of lime.

e. Liquid ammonia dissolves several of the metallic oxides, and with some of them forms crystallizable compounds. It dissolves the oxides of silver, copper, zinc, arsenic, antimony and tellurium: the protoxides of iron, cobalt, and nickel; and the peroxides of tin, mercury, gold, and palladium. These compounds are all decomposed by heat. The compounds of ammonia with the oxides of gold, silver, and platinum detonate when heated, and the oxide and ammonia are both decomposed.

28. **AMMONIA,** *salts of*, are detected, (*a*) by corrosive sublimate; (*b*), by heat; (*c*), by caustic potash, and some other tests.

a. To a neutral solution of an ammoniacal salt, add a drop of any alkali; the solution of corrosive sublimate or perchloride of mercury then added, becomes a delicate test for ammonia by producing a white precipitate.

b. Heat liberates the ammonia in an ammoniacal salt, and the ammo-

nia may be detected by holding a rod dipped in muriatic acid in the vapour. See 11, *d.* and 27 *b.*

c Caustic potash produces, when added to an ammoniacal salt, the odour of ammonia. This distinguishes these salts from other alkaline salts. See 27, *b.* Chloride of platinum detects salts of ammonia by a yellow precipitate of very small crystals, but as it acts also on salts of potash, the one may be mistaken for the other, if the chloride of platinum test, only, be employed. Ammoniacal salts are not precipitated by infusion of nut galls, nor by prussiate of potash.

d. If to an ammoniacal salt dissolved in water a little of any salt containing magnesia be added, and afterwards phosphate of soda be dropped in, a copious white precipitate falls.

29. AMMONIA, *benzoate of,* is an excellent test for separating iron from manganese when together in one solution, which should be accurately rendered neutral. It also liberates iron from all earthy salts, and from nickel, cobalt, zinc and some other metals.

30. AMMONIA, *carbonate of,* detects copper, turning the solution blue, when neutral. This test acts, generally speaking, like ammonia. See table of re-agents. Carbonate of ammonia in its solid state should be entirely volatilized by heat. It may contain impurities, and may be examined in the same manner if used as a test as carbonate of potash, see 98, *d.*

31. AMMONIA, *fluate of,* detects lime, but the oxalate of ammonia is a more common test, though Dr. Henry says, he finds the fluate of ammonia to be the most delicate.

32. AMMONIA, *ferrocyanate of,* this test is of use only in the analysis of saline substances. It may happen, for example, that a fluid contains neutral salts with alkaline bases, together with metallic salts. In this case ferrocyanate of potash cannot be well applied to separate the metallic salts, because it then would be difficult to ascertain whether the alkaline salts were originally present in the solution or not; but if ferrocyanate of ammonia be employed, no ambiguity can result; for the metallic salts need only be precipitated by this test, and the earths by bicarbonate of ammonia, in a temperature of 180°, or upwards, in order to ensure the decomposition of magnesian salts, which this carbonate does not effect in the cold. The liquor may then be separated by filtration, and boiled to dryness, and the dry mass exposed to such a heat as is sufficient to expel the ammoniacal salts. This application of heat will

drive off, also, any excess of the ammoniacal carbonate, which might have retained in solution, either yttria, glucina, or zirconia. The alkaline salts may be separated from these earths, by boiling the mixture in water, and filtering and evaporating it. The salts, with bases of fixed alkalies, will remain unvolatilized. By this process, indeed, it will be impossible to ascertain whether ammoniacal salts were originally present; but this may be easily learned, by adding to the salt under examination, before its solution in water, potash; which, if ammonia be contained in the salt, will produce the peculiar smell of that alkali.

33. **AMMONIA,** *hydro-sulphuret of.* This test acts on a great number of the metals. See the tables of re-agents.

34. **AMMONIA,** *hydro-chlorate, or muriate of, or sal-ammoniac,* detects platinum, producing a bright yellow precipitate, if the platinum be pure. If a solution contain both gold and platinum, the gold may be precipitated by green sulphate of iron, see 67, and the platinum by muriate of ammonia. This test separates alumina from its alkaline solutions; the alkali combines with the muriatic acid, and the liberated ammonia determines the precipitation of the alumina, which after being washed and dried, is perfectly pure.

a. Muriate of ammonia dissolves more or less of all the earthy carbonates when both are together in solution. See pages 95, 178 and 333, of the London and Edinburgh Journal of Science, A. D. 1837, for its action on metals.

b. Sulphate of lead is completely decomposed by a solution of muriate of ammonia; which also acts upon silver with the assistance of air and dissolves it. Muriate of silver is partially dissolved by a concentrated solution of muriate of ammonia, and is still further acted on if boiled.

c. Sal-ammoniac or muriate of ammonia used as a test, ought to be entirely volatilized by a low heat, when laid on a heated iron; if sulphate of ammonia be also present in it, it may be detected by baryta, see 40.

35 **AMMONIA,** *oxalate of,* is a capital test for detecting lime which it is said to indicate, if lime be diluted to the extent of 24,000 times its weight in water. It also occasions a cloudiness with magnesia, but the magnesia does not precipitate till it has stood for several hours. In using this test or oxalic acid, if a mineral acid be present, it must be neutra-

lized; if baryta or strontia be present, they must both be removed previously by sulphuric acid. The following numbers should also be referred to, as sulphuric acid acts on solutions of lime, as well as on baryta and strontia; 18, *b*, *c*, *d*: 40: 44: 72: 115. The presence of other earths in solution along with lime impedes decomposition by oxalic acid, and the oxalates. Thus a watery solution of sulphate of magnesia and sulphate of lime is not precipitated by these tests.

36. **AMMONIA,** *succinate of*, acts like the succinate of soda, which detects the peroxide, but not the protoxide of iron, occasioning a brown precipitate. It precipitates also alumina, if the solution be not too acid. Succinate of ammonia throws down glucina, zirconia and baryta. See 115 c. Both the succinates are useful in separating peroxide of iron from the oxide of manganese; the iron however re-dissolves in an excess of the precipitant.

37. **ANIMAL MATTER** is detected by nitric acid, which occasions it, with cold digestion, to give off nitrogen. Animal matter is thus distinguished from vegetable matter.

38. **ANTIMONY;** *solutions of the protoxide of antimony which are usually of a brownish yellow colour, are best and most readily known by their action with hydrosulphuret of ammonia, which produces a red precipitate, completely soluble in an excess of the precipitant; and by liquid sulphuretted hydrogen, or sulphuretted hydrogen gas, either of which occasions both in acid and neutral solutions, a red precipitate.* If there should be at first merely a red colour in neutral solutions the precipitate is immediately produced by adding muriatic acid, or by heating the solution.

a. Metallic zinc precipitates antimony in a black metallic powder. Tin also precipitates it.

b. Before the blow-pipe with soda, the salts of antimony are reduced in the inner flame, and the bead of metallic antimony remains long in the melted state after being removed from the flame, and gives off a thick white smoke. Afterwards the bead is covered with a net work of crystals of protoxide of antimony.

c. Potash, ammonia, carbonate and bicarbonate of potash, carbonate of soda, phosphate of soda, oxalic acid, gallic acid, prussiate of potass, all produce a white precipitate insoluble in excess of the precipitant. Water produces a white precipitate which is a disalt.

d. Neither nitric, sulphuric, phosphoric, nor carbonic acid forms

salts with protoxide of antimony, at least we are not acquainted at present with any such combinations.

39. **Arsenic** is detected (*a*), by nitrate of silver; (*b*), sulphate of copper; (*c*), sulphuretted hydrogen; (*d*), soda; (*e*), iron. It is also precipitated by salts of lead and by lime water; the precipitates being white.

a. By nitrate of silver, which gives a yellow precipitate in arsenites, and a brown precipitate in arseniates, but the solution ought to be slightly alkaline. This test however must not by itself be considered decisive, as it is acted on by many other substances.

b. By sulphate of copper or by acetate of copper, both of which give green precipitates, but in this case a little carbonated alkali must be present in solution.

c. By sulphuretted hydrogen, which produces a bright yellow colour in acidulated solutions of arsenic, but a precipitate does not form till after long standing.

d. By soda. If arsenic mixed with a little soda be submitted to the action of the blow-pipe, a smell of garlic occurs.

e. The red-acetate of iron detects arsenic by forming a bright yellow deposit. Pure hydrate of iron recently made and suspended in water, completely precipitates arsenious acid.

f. Note. There is much difficulty in detecting small quantities of arsenic, and much caution is required lest false conclusions should be formed; especially in investigations connected with cases of poisoning. The garlic like smell by heat is a good criterion, and still better if confirmed in the following manner. Mix the substance supposed to contain arsenic with fresh made charcoal, or with black flux, in a small glass tube; submit it to heat, and if arsenic be present it will sublime to the upper part of the tube, where it will be deposited and may be recognized by its steel coloured lustre. The open end of the tube must be loosely stopped with a piece of cotton, or other porous substitute, see 2, *a*: and the remainder of this article.

g. The following method for detecting arsenic has been published by professor O'Shaughnessy at Calcutta. See Journal of the Asiatic Society of Bengal, February 1839. Also Jameson's Journal No. 42, or the Arcana of Science for 1837.

h. The beautiful process invented by Mr. Marsh of Woolwich, for the detection of minute quantities of arsenical poison consists in placing

the suspected substance in very dilute sulphuric acid, and introducing a slip of pure zinc. The hydrogen is evolved in combination with the metallic arsenic, and on examination presents most distinct and remarkable phenomena. If ignited, the flame is of a leaden blue colour, and diffuses a powerful smell of garlic and a dense white smoke. If the flame be reduced to the size of a pea and applied to the interior of a thin glass tube, a crust of metallic arsenic is formed in the tube, surrounded by a white ring of arsenious acid. To this, by a little dexterous management, the several tests may be applied, namely the ammoniacal nitrates of silver and copper, and the sulphuretted hydrogen gas. But this process is not entirely distinctive of *all* the arsenical poisons; and tartarized antimony gives almost the same indications upon testing, as the arsenical solutions.

k. Dr. O'Shaughnessy examined the contents of the stomach of a young woman who had been poisoned with crystallized yellow orpiment, (sulphuret of arsenic) but the yellow powder which was separated from the contents of the stomach when treated by the above process gave no indication whatever of the presence of arsenic. He then converted the sulphuret into an oxide, namely, by boiling the yellow matter with a few drops of nitric acid, and after the sulphuret was thus converted into arsenious acid, the process, when applied gave its proper indications. In examinations by this process the Professor therefore recommends that the insoluble contents of the stomach or a part of these contents in cases of poisoning, should be boiled in a capsule of glass or porcelain with small quantities of nitric acid until red fumes are no longer given off. The mass should then be diluted with water, neutralized with carbonate of potash or soda, and lastly examined by Marsh's process.

m. With respect to the indications of tartarized antimony, or tartar emetic, Dr. O'Shaughnessy suggests that the encrusted tube when cold should be moistened with a solution of nitrate of silver in distilled water, and then be held over the mouth of a bottle containing strong ammonia, so that the vapour may traverse the tube. If the crust be arsenical it instantly assumes a vivid canary colour, owing to the formation of arsenite of silver; but no such effect is produced by antimonial compounds. This test therefore affords a simple and conclusive check on Marsh's process.

n. Note.—The zinc of commerce often contains arsenic: the zinc used should therefore be tested; and the same zinc should not be twice used for the same purpose.

39½. **BARYTES** or *Baryta*, when pure is of a greyish white colour, and very friable. It slakes like lime, falling into a powder with heat

when a little water is poured upon it. Solution of barytes in water has a caustic taste; and turns reddened litmus paper blue. Pure barytes does not fuse at a red heat. The following tests discover barytes, as well as its salts, see also 36.

Sulphuric acid produces....	A white precipitate in very dilute solutions; it is not soluble in acids.
Hydrofluosilicic acid	After some time a crystalline precipitate which is almost insoluble in free muriatic or nitric acid.
Pure caustic potash........	A voluminous precipitate which almost disappears on adding a quantity of water.
Caustic ammonia...............	No precipitate.
Carbonate of potash *Carbonate of ammonia* *Neutral phosphate of soda*	A white precipitate soluble in nitric or muriatic acid.
Oxalic acid *Binoxalate of potash*	No precipitate. But if the solution be strong and ammonia be added, a precipitate occurs.
Hydrosulphuret of ammonia *Prussiate of potash* *Red prussiate of potash*	No precipitate.

a. To detect the presence of barytes in sulphate of barytes, a portion is boiled in a solution of carbonate of potash or soda and filtered. The insoluble remainder is treated with muriatic acid, the solution is filtered, and then tested with dilute sulphuric acid which produces a precipitate. The sulphate of strontian is insoluble in acids. The muriatic solution, supposing both baryta and strontian to be present may also be diluted with water, filtered, and hydrofluosilicic acid be added: the barytes will be precipitated as shewn above; but the strontian will not be affected. By this test sulphate of barytes may be discriminated from sulphate of strontian, see 40 *d*, 115 *b*, *d*, *e*.

b. Baryta is precipitated white by phosphates and oxalates (see the test, oxalic acid in this article); pale lemon yellow by chromates, and white by carbonates, see 40 *h*.

c. Barytes, strontites, lime, and magnesia are found always combined with acids, which are generally the carbonic, sulphuric, fluoric, boracic and phosphoric.

40. BARYTA, *solution of; and the acetate; muriate; and nitrate of barytes.* These four tests act alike namely detecting sulphuric acid, either free or in combination; and also carbonic acid. They produce a white precipitate in either case; but the sulphuric precipitate is inso-

luble while the carbonic precipitate is soluble in *weak* muriatic, or nitric acid. Suppose sulphate of potash and carbonate of potash to exist together in solution; on adding any one of the baryta tests, a white precipitate will fall of sulphate, and carbonate of barytes mingled together. They may be separated and their weights ascertained thus. Wash the precipitate with pure water, dry, and weigh it. Then add dilute muriatic or nitric acid, and the carbonate of barytes will dissolve with effervescence; the sulphate will remain untouched. The sulphate washed, and dried, will give its own weight, and the difference between the weight of the sulphate, and the original weight, will be the weight of the carbonate.

a. Solution of barytes, or barytic water is made by dissolving pure baryta in distilled water. It may be employed to separate baryta from strontia in a neutral solution; the baryta having a stronger affinity for acids will be taken up, and the strontia will be precipitated. As barytic water soon spoils, it should be used fresh.

b. Baryta and its combinations are poisonous. A considerable number of its salts are insoluble in water.

c. Baryta in solution is distinguished from the alkalies by its producing a white precipitate with carbonated alkalies, and with dilute sulphuric acid.

d. To distinguish barytes from strontia, dip a piece of paper in the solution. Barytes burns yellow; strontia red, see 115 *c.* To distinguish barytes from lime, see 44, 72 *d*, and 79 *d.*

e. Baryta, acting on carbonic acid, is of course equally acted on and decomposed by the carbonated alkalies: but in this case their precipitate as before shown in this article is soluble with effervescence by dilute acid, either nitric or muriatic. Both the nitrate and muriate of baryta are soluble in water, the sulphate is not.

f. It has been remarked by Berzelius, that when sulphuric acid is precipitated from some of the weaker bases by a barytic salt, the precipitated sulphate of baryta is combined with a portion of those bases. Thus when sulphate of iron or copper is decomposed by muriate of baryta, the sulphate of baryta, when dried and calcined, assumes a reddish colour in the first case, or a yellowish green in the second. In order, therefore, to determine with precision the quantity of sulphuric acid, it is necessary to remove the excess of oxide by some acid in which it is soluble.

g. By the cautious addition of acetate of baryta, as long as it occasions any precipitate, all the sulphates existing in any solution are decomposed, and their bases are obtained united with acetic acid. By evaporating the liquid to dryness, and calcining the residuum, the ace-

tic acid is destroyed, and the bases of these salts may be obtained separate, or combined only with carbonic acid, and in this state may be recognised by properties which are more characteristic than those belonging to them in a state of more energetic combination. In this way the alkaline bases may be obtained separately from the earthy ones; for the addition of water to the incinerated mass takes up the former, and leaves the latter.

h. Phosphoric and oxalic salts occasion a precipitate also, with barytic solutions, which is soluble in dilute muriatic and nitric acids without effervescence. See the last article *b.*

41. **BISMUTH,** *the salts of bismuth may be recognized by water precipitating them;* by the precipitate becoming black by sulphuretted hydrogen, and by a black precipitate with hydrosulphuret of ammonia. *Before the blow-pipe they fuse easily into a brittle button, which flies to pieces under the hammer; the charcoal becoming coated with a yellow powder.* They are distinguished from lead by giving no precipitates with sulphuric acid; and by the brittleness of the fused globules from the blow-pipe.

a. Carbonate of baryta perfectly separates the oxide of bismuth in cold solutions from peroxide of copper, and from lead, manganese, and nickel. The carbonates of lime and magnesia also precipitate bismuth whether in hot or cold solutions. See 69, *c.*

b. The following tests tend further to discriminate bismuth.

Potash, ammonia, carbonate of potash, and carbonate of ammonia—produce white precipitates insoluble in an excess of the precipitant.

Phosphate of soda, a white precipitate.

Oxalic acid: no immediate precipitate but after some time a crystalline precipitate is perceptible.

Prussiate of potash; white precipitate insoluble in muriatic acid.

Red prussiate of potash; pale yellow precipitate soluble in muriatic acid.

Hydrosulphuret of ammonia; liquid sulphuretted hydrogen, and sulphuretted hydrogen gas in a current, produce a black precipitate; but if the bismuth be in small quantity a dark brown precipitate.

Metallic zinc. A black spongy precipitate.

c. Solutions of the salts of oxide of bismuth redden litmus paper.

42. **BRAZILWOOD PAPER.** See litmus 77, which may be used as a substitute.

43. **CADMIUM.** Solutions of cadmium are recognized by their giving yellow precipitates with liquid sulphuretted hydrogen, or with a current of hydrogen gas. This precipitate resembles orpiment, but it may be distinguished by the facility with which it dissolves in muriatic acid and by its bearing a red heat without being altered. Before the blow pipe, with soda, the salts of cadmium coat the charcoal with a brownish red or orange coloured powder.

a. A considerable number of the salts of cadmium are soluble in water, and the solutions are colourless, or have a slight yellow tinge. The insoluble salts are white powders, and dissolve in acids.

b. The pure oxide of cadmium gives a reddish brown powder. The hydrated oxide is white. The oxide is soluble in ammonia and easily dissolves in acids, and acts towards re-agents as follows.

c. Potash, carbonate of potash, and carbonate of ammonia produce a white precipitate, and hydrosulphuret of ammonia, in neutral solutions, a yellow precipitate; all of which precipitates are insoluble in an excess of the precipitant. Henry says, the fixed alkalies throw down a white hydrated oxide soluble in ammonia. Prussiate of potash and oxalate of ammonia cause a white sediment.

d. Ammonia produces in neutral solutions a white precipitate, easily soluble in an excess of ammonia; oxalic acid does the same.

e. Solutions of the neutral cadmium salts redden litmus paper.

f. A plate of zinc immersed in a solution of cadmium precipitates it in dendritical leaves; or according to others in grey coloured spangles.

g. Cadmium resembles tin very nearly, in colour, lustre, and the sound it emits when bent. It melts below a red-heat, and volatilizes at a heat not much greater than that which volatilizes mercury; it condenses in drops.

44. **CALCIUM,** *lime is detected by oxalate of ammonia, oxalic acid, or bin-oxalate of potash, all of which produce a white precipitate of oxalate of lime which is soluble in nitric acid;—the precipitation is assisted by the addition of ammonia to neutralize any free acid.* See 15,35,72. Sulphuric acid, and the carbonated alkalies, and phosphate of soda, also detect lime, but not so satisfactorily as oxalic acid, or the oxalates.

a. Calcareous salts are, in concentrated solutions, distinguished from alkaline salts by giving a white precipitate with carbonate of potash; or dilute sulphuric acid. Lime is distinguished from barytes by its giving no precipitate with hydrofluosilicic acid. See 40, 72 *b*; 79 *d*.

b. A concentrated solution of lime is acted on as follows by the undermentioned tests.

Carbonate of potash; or potash. Dense white flocculent precipitate.

Sulphuric acid. Dense white powdery precipitate.

Oxalic acid. Dense white cloud which precipitates more slowly than the others.

c. Hydrochlorate of lime in crystals deliquesces, hydrochlorate of baryta does not. The crystals of the latter are four sided tables, the crystals of hydrochlorate of strontian are delicate six sided prisms. These characteristics may assist in distinguishing barytes, lime, and strontia, from one another: see 72 *e*, and 79 *d*.

45. CARBONATE *of lime* and some other carbonates, are useful in analysis to separate different substances, see 65 *c*, *d*; 69 *c*.

☞. Carbonates are sometimes not acted on by acids when in combination with alcohol and æther, see 73.

46. CERIUM gives with the following tests the indications specified opposite to each.

Potash	A white voluminous precipitate; insoluble in excess of the precipitant.
Ammonia	The same; gelatinous. Insoluble in an excess of ammonia.
Carbonate of potash *Carbonate of ammonia*	The same; soluble in excess of precipitant, but precipitated if boiled.
Phosphate of soda	White precipitate in neutral solutions, soluble in nitric and muriatic acid.
Oxalic acid	White curdy, do. do. do.
Sulphate of potash	Crystalline precipitate, if the solution be not too dilute.
Prussiate of potash	White chalky precipitate.
drosulphuret of ammonia	Do. of protoxide of cerium.
Sulphuretted hydrogen gas *Gallic acid*	No precipitate.

Pure hydrate of cerium is white, becoming yellowish by exposure to the air. The neutral salts redden litmus paper.

a. The detection of protoxide of cerium in the compounds of protoxide of cerium which are insoluble in water is attended with some difficulty. The best way is to dissolve such a compound in an acid and to place a crust of crystals of sulphate of potash in the solution, which will produce the double sulphate of protoxide of cerium and potash,

which is insoluble in a solution of sulphate of potash, and sparingly soluble in water.

b. A mixture of cerium and iron may be separated, by boiling in oxalic acid; the iron dissolves and the cerium is left in the state of a white powder decomposable by heat, see 65 *d.*

c. Solutions of protoxide of cerium are distinguished from those of alkalies, barytes, strontian, lime and magnesia, in the same manner as solutions of alumina are distinguished from those substances, see 26 *c.* From alumina and glucina, the protoxide of cerium is distinguished by its insolubility in an excess of potash; from thorina, by its relation to heat. The latter does not become red when ignited, neither does it give a coloured bead when fused with borax, or microcosmic salt, before the blow-pipe. When this proof is made, the substance must of course have been freed from iron. Protoxide of cerium is distinguished from yttria in the same manner as from thorina, and also by its behaviour towards a solution of sulphate of potash.

47. CHLORINE, *Muriates* or *chlorides are detected by nitrate of silver which produces a white precipitate of muriate, or chloride of silver insoluble in nitric acid, but soluble in ammonia, and blackening in the light, or more quickly in the sun,* see 108. Solutions of lead and mercury also detect muriatic salts, but pure chlorates are not affected by these tests. See 70 *b,* and 83 *b.*

a. The precipitate by nitrate of silver is not decomposed at a red heat: but it melts, and upon cooling forms a crystalline, sometimes translucent mass, which cuts somewhat like horn, from which it has been called horn-silver: it is the lunar caustic of the apothecary, which is soluble in water, and is then a proper test for muriatic acid.

48. CHROMIUM, or chromic acid, is detected by proto-nitrate of mercury which forms a red precipitate becoming green when strongly heated: also by hydro-sulphuret of ammonia, and prussiate of potass, both of which produce green precipitates. Rose says, prussiate of potass produces no precipitate. Nitrate of silver produces a carmine colour changing to purple, and nitrate of copper a chestnut red. See the tables of re-agents.

a. The salts of chromic acid are precipitated by salts of lead of a yellow colour: by salts of silver of a reddish brown; by protoxide salts of mercury of an orange colour, and this precipitate heated leaves protoxide of chromium. Salts of baryta produce a lemon-yellow precipitate. When mixed with a little alcohol and nitric acid, chromic acid,

immediately assumes a bluish-green colour which preserves the same shade even after dessication.

b. Solutions of chromium are distinguished by their green colour, which undergoes no alteration on being treated with sulphuretted hydrogen. Chromium gives an emerald green before the blow-pipe, and imparts a beautiful green colour to the fluxes. This colour is discriminative; it occurs both in the inner and outer flame, and distinguishes chromium from copper, which produces a green bead only in the outer flame.

49. COBALT. Pure oxide of cobalt has a greenish grey colour; *and both it and cobalt salts are easily detected before the blow-pipe by producing an intensely blue glass when mixed with 20 times its weight of borax.* It may also be known by its solution in acid being of a violet red, or rose colour; by alkalies producing a precipitate of violet blue, and by alkaline hydro-sulphurets giving a black precipitate. Carbonate of potash produces in cobalt solutions, a red precipitate, which, upon being boiled becomes blue. See table of re-agents.

a. The following tests act on cobalt, and produce the colours specified.

Potash. Blue; after repose green: if boiled dirty pale red.

Ammonia. Blue; more ammonia turns the precipitate green, and still larger quantity dissolves the precipitate and forms a green solution.

Carbonate of potash. Red; if boiled blue.

Carbonate of ammonia. In neutral solutions, red; soluble in muriate of ammonia.

Phosphate of soda. In neutral solutions, blue.

Prussiate of potash. Green turning grey.

Hydrosulphuret of ammonia. In neutral solutions, black.

b. Solutions of cobalt-salts are particularly distinguished from zinc, manganese, zirconia, cerium, yttria, thorina, glucina, alumina, and the earths and alkalies, by producing a black precipitate with hydrosulphuret of ammonia. This precipitate is hydrosulphuret of cobalt.

c. An impure oxide of cobalt fused with a mixture of sand and potassa, produces a blue glass, which, reduced to powder, is known in commerce by the name of smalt.

d. Neither cobalt nor nickel is precipitated by the carbonate of lime or of magnesia.

50. COLUMBIUM. There is great difficulty in separating columbium from other substances. The infusion of galls produces in solutions of columbium an orange precipitate, and the recently prepared oxide of the metal is soluble in citric, tartaric, or oxalic acid. The columbate of potash is crystallizable, and the oxide of the metal is immediately precipitated on the addition of an acid.

51. COPPER in solution, is detected by ammonia which in small quantity turns it first green, then blue; but if iron be also in solution, it ought first to be removed. Clean iron free from rust precipitates metallic copper, and this distinguishes copper from nickel, for ammonia turns nickel also blue. Metallic zinc causes a black precipitate. *The ammonia and iron conjointly are decisive tests.*

Potash produces a voluminous blue precipitate (hydrated oxide) which when boiled with an excess of potash turns black and quickly subsides. If the potash is insufficient, a light green precipitate occurs.

Ammonia, in small quantity occasions a green precipitate which easily dissolves in more ammonia and produces a blue solution. If this solution be boiled with caustic potash a dense black precipitate is formed.

Carbonate of potash. A blue precipitate, rendered black by boiling.

Carbonate of ammonia. Same as ammonia.

Phosphate of soda. A greenish white precipitate soluble in ammonia and if potash be added, a dense black precipitate takes place on boiling.

Oxalic acid. A greenish white precipitate.

Prussiate of potash. A reddish brown precipitate insoluble in muriatic acid. This and clean iron are trust-worthy tests, but the solution should be either neutral or slightly acid, and not alkaline.

Red prussiate of potash, a yellow green precipitate insoluble in muriatic acid.

Hydrosulphuret of ammonia, liquid sulphuretted hydrogen, and a current of sulphuretted hydrogen gas, give black or dark brown precipitates according to the quantity of copper in solution.

Metallic zinc or tin precipitates copper black.

Metallic iron, pure copper.

a. Persalts of copper turn blue with ammonia; blue with potassa; reddish brown with prussiate of potassa, and black with hydrosulphuret of ammonia. By these indications copper may be distinguished from other metals and from nickel, as before stated, as well as also by its action with solution of potassa, and sulphuretted hydrogen: the first of

which turns nickel apple green, but copper blue; and the second produces no immediate precipitate with nickel, but with copper it does. The hydrated blue oxide of copper is converted to black by boiling.

b. The greater number of the salts of copper are soluble in water, and speedily acquire a blue or green colour on exposure to the air. The salts of sub-oxide of copper are never blue or green, but white, red, brown or black.

c. The deutoxide of copper is black: it fuses on exposure to a very strong heat. It readily dissolves in acids. The solution has generally a blue colour. The muriate solution is of an emerald green colour.

d. The solutions of neutral salts of deutoxide of copper redden litmus paper.

e. Before the blow-pipe with soda on charcoal the salts of copper are reduced to a metallic globule. With borax they give a dark green in the exterior, and a reddish brown colour in the interior flame.

f. Copper in solution may be decisively distinguished by the joint action of ammonia and clean iron. Clean iron dipped into and remaining a few minutes even in a weak solution of copper, becomes coated with it.

g. Persalts of copper have a blue or green colour, prosalts are colourless, but absorb oxygen rapidly and become blue.

52. **COPPER**, *metallic* detects and precipitates silver in solution. The solution should be somewhat acid in order to precipitate the silver completely.

a. The following analysis may be introduced here to point out the method of separating copper, from nickel and zinc. See also 41, *a*.

b. 24½ grains of copper, 12 grains of zinc, and 20 grains of oxide of nickel were dissolved in nitromuriatic acid. The solution, strongly acidified with muriatic acid, was diluted with about a pint of water; a current of sulphuretted hydrogen gas was then passed through the solution until all the copper was precipitated; the bisulphuret of copper thus formed, having been well washed, was acted on by nitric acid, which dissolved the copper and left some sulphur; after the separation of the latter, the solution of copper was boiled with caustic soda to precipitate the peroxide, which after ignition weighed 30.4 grains which is equal to 24.3 grains of copper. The solution containing the zinc and nickel was carefully evaporated to dryness to expel the excess of acid, and the residue dissolved in water acidulated with one fluid ounce of strong acetic acid S. G. 1.069 and warmed to assist the action. When this was effected, the solution was diluted to about a pint, and a stream of sulphuretted hydrogen was passed through it until the gas was in excess. A dingy white precipitate of sulphuret of zinc fell which weighed 18 grains, equal to 12 grains of metallic zinc. The

remaining solution containing the nickel, after being heated to expel the sulphuretted hydrogen was decomposed by caustic soda; this gave hydrate of nickel, which, when reduced to protoxide by strong ignition, weighed 20.1 grains. In this experiment there was a loss of 0.2 grains of copper, and a surplus of 0.1 grain of oxide of nickel; errors so small that they are evidently those of manipulation. London and Edinburgh Journal, vol. 8, page 81, 1836.

c.—*Nitrate* of copper is reduced by zinc, lead, cadmium, and tin: cobalt acts very slowly, and bismuth but imperfectly even when the solution is hot. The reduced copper appears with metallic lustre only upon cobalt, lead, and clean iron, with other metals it forms a brown, or black alloy. *Chloride* or *muriate* of copper is easily decomposed by iron, tin, zinc, cadmium, and cobalt, and slowly by lead if the solution be not acid. The *ammoniacal* solution of copper is reduced only by zinc, iron, and cadmium, not by tin, lead, or cobalt. Zinc is by far the most effectual precipitant of copper.

53. **CORROSIVE SUBLIMATE** called also *per-muriate; oxymuriate; bichloride, and perchloride of mercury* detects albumen and ammonia; heat must be employed to separate the whole of the albumen contained in any solution; it will fall down in a flocky precipitate, which when carefully dried will contain about 78 per cent. of albumen. To detect ammonia, see 28. Corrosive sublimate is detected by lime water, see 75.85.

a. The perchloride of mercury in solution removes stains on the skin caused by nitrate of silver, and it also effaces the so called indelible ink for marking linen, the base of which is nitrate of silver, or the lunar caustic of the apothecary.

54. **FLUORINE** *fluates*, *fluoric acid*, these substances are detected by glass, thus; *the fluoride, or fluate is to be reduced to powder, and mixed with sulphuric acid to the thickness of paste, it may then be put into a leaden dish, and heated over a spirit lamp; fluoric acid will escape, and if glass be held over its fumes it will be thereby corroded.* If the glass is covered with wax and tracings be marked on it down to the glass, etchings may be produced. The gas, or fumes of the acid are poisonous, and must not be inhaled. See 18, a.

55. **GALLS**, *tincture of*, *detects iron in solution turning it black or purple.* See 8. 65. Alkaline or earthy salts, if present, influence the colour changing it to violet or purple. Sulphate of lime

makes it first whitish, and afterwards black. When the quantity of iron is small, as in some mineral waters, a slice of gallnut may be suspended in the liquid by a silk thread for two or three days. The iron ought to be in the state of peroxide for the gall test to act immediately. If it be in the state of protoxide, the test does not act till after some time. Gall tincture acts also on other metals. See the tables of re-agents.

a. By applying tincture of galls to a solution before and after boiling, it may be known whether the iron is held in solution by carbonic, or by a mineral acid. If the tincture acts before boiling and not afterwards, carbonic acid is the solvent. If it acts both before and after boiling, a mineral acid is the solvent. If by the boiling, a yellowish powder be precipitated, and yet the gall tincture continues afterwards to discolour the solution, the iron, as often happens, is held in solution by both carbonic, and a mineral acid.

56. GELATINE, see jelly.

57. GLUCINA is detected by the carbonated alkalies. See the tables of re-agents. Salts of glucina are not precipitated by oxalate of ammonia, nor tartrate of potash, which distinguishes them from the salts of yttria. The tests for alumina act in the same manner with glucina as they do with alumina. See 26.

a. Glucina is distinguished from alkaline and calcareous salts in the same manner as alumina. It is distinguished from alumina by giving no crystals of alum with potash and sulphuric acid; and by the colour of its flame before the blow-pipe becoming dark grey, or black; and not blue, like alumina.

b. Litmus paper is reddened by the neutral salts of glucina.

c. Glucina, yttria, and zirconia occur in but few minerals, and in small quantity. They are rarely met with.

58. GLUTEN detected, see 1.

59. GOLD is detected by sulphate of iron, or by sulphurous acid, which produce in very dilute solutions first a blue colouring, and afterwards a brown precipitate of metallic gold; by oxalic acid which occasions a greenish black colour, metallic gold afterwards subsiding; and by fresh made muriate or proto-chloride of tin which gives a purple precipitate, see 122. *Solutions of Gold may be distinguished by the*

united action of these three tests. Hydrosulphurets produce a dark brown, or black precipitate. See the tables of re-agents.

a. Protonitrate of mercury precipitates gold as a mixture of calomel and metallic gold. Sulphurous acid precipitates gold in the metallic state. Gold is easily reduced by soda on charcoal before the blow-pipe. It is refined by cupellation, and by quartation.

60. GOLD, *muriate of,* detects tin producing a purple precipitate, but a little carbonate of soda should be present in solution. The colour of the precipitate varies in proportion to the relative quantities of the tin and the test. The colour produced may be violet, or even rose coloured, see 122.

61. HYDROGEN *sulphuretted,* acts on most of the metals. See the tables of re-agents. This test is useful in analysis either by itself in the form of gas, or in combination with water, it precipitates many of the metals in the form of sulphurets. See 62 for detecting this substance.

62. HYDROSULPHURETS *in solution* are detected by acetate of lead producing a black precipitate; by nitrate of silver, or nitrate of mercury producing also a black precipitate; by arsenious acid producing a yellow precipitate, and by silver leaf, or quicksilver which becomes tarnished, see the tables of re-agents.

63. IODINE is detected by starch which produces an indigo blue colour; but this blue colour is discharged when the solution is made hot. Starch and iodine are reciprocal tests.

a. In testing for iodine the iodine must be free, if not, a minute quantity of acid must be added. The solution of starch, (i. e. the test) must be used cold. The precipitate, ioduret of starch, is soluble in dilute sulphuric acid. Iodine is soluble in alcohol. A stream of sulphuretted hydrogen destroys the blue colour, after starch has produced it in any solution that may be under examination, see 9 and 113.

64. IRIDIUM is detected by sulphuretted hydrogen which produces a dark brown or black precipitate, but this precipitate is not distinctive of the metal. Ammonia and the fixed alkalies produce a yellow precipitate; and tincture of galls instantly destroys the red colour of the solution. Iridium may be precipitated (reddish brown) by muriate of ammonia, or the chloride of potassa, but both the test and the

metallic solution must be concentrated, and then very strong alcohol must be added so that the liquid may contain 60 per cent of it in volume. The precipitate will be chloride of iridium and the alkaline matter, both of which are insoluble in alcohol. The solution should contain a small excess of chloride of potassium;—the precipitate may be washed with spirits of wine.

a. The muriate of iridium is iridescent having a brown or green tinge; yields a red solution with water, which is rendered colourless by alkalies, sulphuretted hydrogen, ferrocyante of potash, and infusion of galls. No precipitate is produced by carbonate of soda.

65. IRON *is detected by tincture of galls, which produces a purple colour, see 55: also by ferrocyanate of potash which produces a blue colour.*

a. Solutions of protoxide of iron may be discriminated by their action with hydrosulphuret of ammonia which gives a black precipitate, and by the red prussiate of potash producing a dark blue precipitate; and the peroxide of iron by hydrosulphuret of ammonia, prussiate of potash, and liquid sulphuretted hydrogen; by which the indications are respectively, a black precipitate by the first, a dark blue precipitate insoluble in muriatic acid by the second; and a milky white precipitate of separated sulphur by the last. These tests discriminate iron from other bases.

b. The neutral solutions of iron redden litmus paper.

c. When carbonate of lime, or carbonate of magnesia is boiled with a solution of peroxide of iron, and protoxide of manganese, the iron is completely precipitated, and the whole of the manganese remains held in solution. See 29.

d. When protosalts and persalts of iron exist together in solution, if the solution be boiled with carbonate of magnesia, the persalt is completely separated, and precipitates in the state of a sub-salt. See 36. The carbonate of lime, of baryta, of strontian, or of magnesia, when added to a cold solution of peroxide of iron, so completely separates it, that no re-agents indicate a trace of it afterwards. The carbonates of baryta and strontia are to be preferred. This is said to be an excellent process for procuring also oxide of cerium entirely free from peroxide of iron.

e. The following list shews the colours of the precipitates of the protoxide and peroxide of iron, using the same test in both cases.

PROTOXIDE: (*blue*).	PEROXIDE: (*red*).
Potash, flocky hydrate precipitate nearly white changing to grey, green, and finally reddish brown, where in contact with the atmosphere.	*Potash*, voluminous reddish brown precipitate of hydrate of iron.
Ammonia, same as potash: if muriate of ammonia be present no immediate precipitate, but on exposure to the air a small green precipitate falls.	*Ammonia*, same as potash.
Carbonate of potash, and carbonate ammonia, white precipitate of carbonate of iron, becoming green, and then reddish brown, soluble in muriate of ammonia, which however lets fall a green precipitate after standing exposed to the air.	*Carbonates of potash, and ammonia*, reddish brown with both tests.
Phosphate of soda white, turning green.	*Phosphate of soda*, white: if ammonia be added brown, and after some time completely dissolves.
Oxalic acid, after some time a yellow precipitate of oxalate of iron soluble in muriatic acid.	*Oxalic acid*, no precipitate, but a yellow colour.
Prussiate of potash, light blue changing dark. Insoluble in muriatic acid.	*Prussiate of potash*, immediate dark blue; insoluble in muriatic acid.
Red prussiate potash, immediate dark blue. Insoluble in acids.	Red prussiate of potash, no precipitate.
Hydrosulphuret of ammonia, black, being sulphuret of iron, turning reddish brown in air. This brown colour distinguishes iron from nickel and cobalt.	*Hydrosulphuret of ammonia*, black precipitate becoming reddish brown in air.
Liquid sulphuretted hydrogen; and sulphuretted hydrogen gas.—No precipitate.	*Liquid sulphuretted hydrogen, and sulphuretted hydrogen gas*, in neutral solutions a milky white precipitate of sulphur; and the solution becomes protoxide.

Muriate of gold. } Precipitate becomes gradually purple, but a little carbonate of soda should be added.

f. Iron ores, as magnetic iron ores, sometimes contain both protoxide and peroxide of iron. To detect them dissolve the ore in a closed flask with concentrated muriatic acid: add to one portion of the solution a saturated solution of sulphuretted hydrogen, and a milky white precipitate will indicate the peroxide. Dilute with water the other portion of the solution and test it by red prussiate of potash and the dark blue precipitate will indicate the protoxide. See 36; also letter *d* of this article.

g. The protoxide salts of iron which are insoluble in water are nearly all soluble in muriatic, or diluted sulphuric acid. This resulting acid solution when supersaturated with ammonia, generally precipitates the salt, Hydrosulphuret of ammonia added thereto blackens this precipitate. The same remark is generally applicable to the persalts of iron.

h. Before the blow-pipe the salts of iron yield with borax a glass, which, in the outer flame, is of a deep red, becoming lighter as it cools. In the inner flame it is green when hot, but colourless when cold, unless a large quantity of protoxide of iron is present. To microcosmic salt, very small quantities of iron impart a green colour while hot, which fades in cooling and disappears entirely when cold. With soda on charcoal the salts of iron are reduced and yield after washing away the particles of charcoal, a magnetic powder.

66. IRON, *metallic* is a good test for copper in solution, precipitating it in the state of pure copper. The solution should be slightly acid, and the iron should be clean and free from rust. The weight of the copper cannot however in delicate experiments be correctly ascertained by this method of precipitation.

67. IRON, *protosulphate* of, detects 1, oxygen gas in water, which shortly after the test is applied turns turbid : 2 gold: 3 palladium, both of which are precipitated in the metallic state: 4, gallic acid, which turns purple. It also detects hydrocyanic acid ; see 10.

a. Sulphate of iron may be likely to contain copper; if used as a test, the copper may be detected by ammonia: any copper that may be present may be precipitated by clean iron, and the solution be thus purified.

b. I am indebted to a friend for the following. Protosulphate of iron is a convenient test for ascertaining whether a piece of chunam (or mortar) is combined with carbonic acid, or not. If a piece of plaister be taken which is partly combined with carbonic acid and partly not, and

be dipped into a solution of protosulphate of iron, a deposit of the protoxide of iron takes place on that part which is *not* combined with carbonic acid, and turns it of a dark green colour, changing eventually to an orange yellow. Many other metallic solutions, such as the bichloride, and the proto and pernitrates of mercury and the nitrate of silver, do the same thing, but the colours produced by them are different from the foregoing.

68. **JELLY**, or *gelatine*, is detected by tan, or tanning, which produces an adhesive mass. An immediate precipitate with tan may be considered as a pretty certain indication of gelatine. The test acts on albumen also, but not immediately, see 118. Corrosive sublimate does not act on gelatine, but it acts powerfully on albumen.

69. **LEAD** is detected by sulphuric acid, and by muriatic acid. The sulphuric acid may be free, or in combination as sulphate of soda, or potash. The precipitate by muriatic acid is soluble in twenty-two parts of water at 60° Faht. and in weak nitric acid. It is also soluble in boiling water and crystallizes on cooling. Alkaline sulphates are good tests for lead. See the tables of re-agents.

a.—The solutions of protoxide of lead may be distinguished by their action with sulphuric acid which produces a white precipitate; and from alkaline earths by hydrosulphuret of ammonia, which produces a black precipitate with lead, but not with the earths.

b.—Sulphate of lead is soluble in pure potash, but very sparingly soluble in dilute acids. *Treated with soda on charcoal before the blowpipe all the salts of lead give buttons or globules of metallic lead.*

c. Carbonate of lime, or of baryta added to a cold solution of nitrate of lead, and nitrate of bismuth, precipitates the bismuth; but if the mixture be boiled both metals are completely precipitated. Lead may be thus separated from the bismuth of commerce, and also from alloys of copper, see 41 *a.*

d. Pure protoxide of lead is yellow, but its powder has a reddish hue. The best solvent for it is nitric, or acetic acid. When it does not wholly dissolve in these acids it is impure. The red oxide of lead, is, by a strong heat converted into protoxide of lead: when put into nitric, or acetic acid it becomes brown being partly converted into protoxide which dissolves in the acid, and partly into the brown oxide of lead, which if heated gives out oxygen gas, and is changed into the protoxide without going into the intermediate state of the red oxide.

e. The following tests act on protoxide of lead in solution as follows. *Potash.* A white precipitate soluble in excess of precipitate.

Ammonia. A white precipitate insoluble in ammonia: acetate of lead is not affected by ammonia, but after some time a subsalt is deposited.

Carbonate of potash *Carbonate of ammonia*	A white precipitate soluble in pure potash.
Phosphate of soda.	The same, but the solution must be neutral.
Oxalic acid *Prussiate of potash*	In neutral solutions, a white precipitate.

Red prussiate of potash. No precipitate.

Hydrosulphuret of ammonia. A black precipitate insoluble in excess.

Metallic zinc, precipitates metallic lead in blackish grey shining spangles, or if it be suspended by a silk line in a solution of lead the latter forms around it a crystalline arborescence.

70. LEAD, *acetate of,* detects (*a*) sulphuric acid; (*b*) muriatic acid; (*c*) alkaline and earthy carbonates; (*d*) phosphoric acid; (*e*) hydrosulphurets and sulphuretted hydrogen; (*f*) carbonic acid; and (*g*) boracic acid.

a. Sulphuric acid, and the alkaline sulphates are detected by giving a white precipitate of sulphate of lead.

b. Muriatic acid is also detected by giving a white precipitate, which is muriate, or chloride of lead.

c. Alkaline and earthy carbonates are detected by a white precipitate; but if the solution in which they are contained be first saturated with nitric acid the test does not discover them.

d. Phosphoric acid and phosphates produce with this test, a white precipitate that melts before the blow-pipe into a pearl white globule, which eventually becomes pure lead.

e. Hydrosulphurets, and sulphuretted hydrogen turn black on the application of this test.

f. Carbonic acid is better discovered by other tests than by acetate of lead.

g. So also is boracic acid, see 3.

71. LEAD, *subacetate of,* deprives wine of its colouring matter. It acts on a variety of animal and vegetable matters, and is not therefore a discriminative test.

a. If acetate, or subacetate of lead used for testing should be mixed with acetate of lime, or baryta, the former i. e. lime may be detected by adding to a dilute solution, oxalic acid, or oxalate of ammonia; and the latter by sulphuric acid, the solution being largely diluted. Acetate of

lead ought to be entirely soluble in water: any insoluble matter may be regarded as an impurity.

72. **Lime** *is detected by oxalate of ammonia;* see 15 *b*, and by sulphuric acid, but the latter will not discover lime if it is held in very dilute solution, see 15,35,44.

a. A considerable number of the salts of lime are insoluble in water. Some of those that are soluble cannot be easily crystallized. When a salt of lime is insoluble in water if it be boiled for some time in a solution of carbonate of potash, a white powder remains which is soluble in nitric acid with effervescence, and which possesses all the properties of, and is in fact carbonate of lime.

b. To distinguish precipitated sulphate of lime from the sulphate of barytes, or of strontia, wash it well, and boil it in a considerable quantity of water; filter, and divide into two portions; to one, add muriate of barytes, to the other oxalate of ammonia. If a white precipitate be produced in both cases, and the precipitate by the muriate of baryta be insoluble in muriatic acid, then the base of the sulphate is lime. The sulphate of baryta is insoluble in water; the sulphate of strontia is not quite insoluble, but very nearly so.

c. Salts of lime are distinguished from alkaline salts by giving white precipitates with carbonate of potash, and if not too dilute with sulphuric acid.

d. Lime may be distinguished from baryta by its giving no precipitate with hydrofluoric acid; and when in very dilute solution, by its giving no precipitate with sulphuric acid. Baryta is acted on by both those tests.

e. Lime may be distinguished from strontia by sulphuric acid, but the lime must be in weak solution. Strontian gives a white precipitate with sulphuric acid and acts more rapidly on adding ammonia, but if the solution of strontian be very dilute the precipitate does not take place immediately. The same method of discrimination may be followed with respect to barytes. Sulphuric acid detects both strontia and barytes in much weaker solutions than it detects lime, see 79 *d.* Lime may be further distinguished from barytes and strontia thus: nitrate of lime crystallizes in prisms, is very deliquescent, and is soluble in alcohol. The nitrates of barytes and strontian crystallize in octahedrons, or segments of octahedrons; are not deliquescent, and do not dissolve in pure alcohol, see 44 *c*.

f. Lime is always found in nature combined with an acid, see 39½ *c*.

g. Lime and magnesia are frequently found together in magnesian lime stone; they may be separated as shewn under the article magnesia, 79 *e.*

73. LIME, *carbonate of.* Anhydrous alcohol; sulphuric æther; and acetic æther disguise more or less the properties of the strongest acids. Their solution in these etherial spirits does not redden litmus paper nor decompose a great number of the carbonates. But artificial carbonate of lime, and even marble itself is attacked with extreme violence by a solution of muriatic-acid-gas in alcohol, although diluted with many times its volume of water. This gas in alcohol attacks, also, but less strongly the carbonates of barytes, strontia, magnesia and soda, even when they have been previously calcined; but it does not decompose carbonate of potash. Concentrated nitric acid mixed with alcohol does not decompose carbonate of potash, but it acts energetically upon the carbonates of lime and strontia; it acts less powerfully on the carbonates of barytes, magnesia, and soda.

a. Oxalic acid which disengages carbonic acid from the carbonates of strontia, magnesia, and barytes does not act at all on the carbonate of lime, or of potash in alcoholic solutions. These facts shew that on some occasions in which alcohol is employed in chemical investigations, it will prevent the operator from discovering the presence of an acid by litmus paper.

b. A mixture of about six parts of absolute alcohol and one part of concentrated sulphuric acid does not act upon any neutral carbonate; but it decomposes acetate of potash.

c. Carbonate of lime, and some other carbonates are useful in analysis to separate different substances, see 65 *c. d.* and 69 *c.*

d. To distinguish *carbonate* of lime from lime, see 67 *b.*

74. LIME, *muriate of*, may be used as an auxiliary to discover alkaline carbonates. The carbonates of potash, soda, or ammonia separates from this test the lime, and the muriatic acid in the test combines with the alkali producing muriate of potash, soda, or ammonia, as the case may be. The alkaline base must be discovered by appropriate tests, see 28, 98, 110.

75. LIME WATER, detects carbonic acid producing a white precipitate of carbonate of lime. With salts having a base of magnesia or alumina, and with sulphates it gives a cloudiness or a precipitate. It also detects corrosive sublimate producing a precipitate of a yellow, or brick dust colour, which becomes transparent on the addition of an acid.

a. Lime water soon spoils if exposed to the air. It is made by adding distilled water to fresh slacked lime and stirring it repeatedly during 24 hours. It should be kept in well stoppered bottles.

b. Where neither uncombined carbonic acid, alkaline nor earthy carbonates, alumina, nor oxide of iron exist in a mineral water, lime water is one of the best precipitants of magnesia. One twelfth part of a grain in a pint of water may be detected.

c. Lime water decomposes a neutral solution of platina if exposed to the sun's rays. See 96, d.

76. LITHIA, the detection of this substance by re-agents is somewhat difficult. But the lithia in salts of lithia may be detected before the blow-pipe. When a portion is melted upon the end of a platina wire bent into a ring, and the melted mass is placed at the point of the inner flame, then the outer flame acquires a beautiful and very strong carmine red colour, see 115 *g*. The chloride of lithium acts the most strikingly. When the lithia salt is mixed with a potash salt, then the red colour alone is produced before the blow-pipe, and the presence of potash, even when the assay contains more potash than lithia, cannot be detected by its behaviour before the blow-pipe. When on the contrary, a lithia salt is mixed with a salt of soda, then only the re-action of the soda is observable, and the outer flame, even when an excess of lithia is present, acquires merely a yellow colour. This is also the case when a lithia salt contains salts of both potash and soda.

a. The spirituous solutions of lithia salts burn with a beautiful carmine red flame, particularly when the spirit is nearly consumed, and the burning liquid is stirred with a glass rod.

b. The presence of lithia, in solutions of the salts of lithia, is best determined as follows. The operator first assures himself, by the addition of a solution of carbonate of potash or carbonate of soda, that the salt in solution is actually an alkaline salt, which point is determined if this test, on being added to a not very concentrated solution of the compound, produces no precipitate. In the next place, if the solution be not troubled by solutions of tartaric acid and chloride of platinum, the absence of potash is determined. If farther, the solution, on being mixed with a solution of phosphate of soda and ammonia, produces, after some time, a strong precipitate, the presence of lithia is determined, and that substance is hereby distinguished, more particularly from soda, but also from potash. Finally, lithia can be sufficiently discriminated from the other two alkalies by its behaviour before the blow-pipe.

c. Neither carbonate nor phosphate of soda; phosphate of potash; tartaric acid; oxalic acid; chloride of platinum; hydrofluosilicic acid, nor sulphate of alumina produces any precipitate in solutions of lithia. If phosphate of soda and then ammonia be added to a solution of lithia a precipitate is produced but not instantly.

d. The solutions of the salts of lithia act upon reddened litmus paper in the same manner as the corresponding salts of potash and soda, see 98 *c*; and 110 *d*.

77. **LITMUS,** *the solution and tincture of litmus, and litmus paper all act in the same manner, namely, from blue, their natural colour they turn red on the application of an acid.* See 73, for exceptions to this general rule, also *b* in this article.

a. Fixed acids turn litmus permanently red; volatile acids produce a transient red which disappears on the application of heat, or when the paper gets dry. Carbonic acid and sulphuretted hydrogen in water turn litmus a transient red, before, but not after boiling.

b. The salts of silver and manganese have no effect on litmus paper. The salts of nickel and cobalt affect it slightly, but solutions of the neutral salts of all the following substance turn it red:—

Antimony,	Iron,
Alumina,	Lead,
Bismuth,	Mercury,
Cadmium,	Platinum, the oxide, not the chloride,
Cerium,	Tin,
Copper,	Yttria,
Glucina,	Zinc,
Gold,	Zirconia.

c. Solution of boracic acid changes blue litmus to red or reddish; and renders turmeric paper brown.

78. **LITMUS** *reddened. Litmus or litmus paper reddened by diluted vinegar, or by any very weak acid becomes a test for alkalies.* The blue litmus is a test for acids. Suppose a piece of blue litmus paper to be dipped into a weak acid, it will turn red; if it then be dipped into an alkaline solution it will turn blue, and regain its natural colour. This effect will be produced as often as it is dipped alternately into an acid or alkaline solution of equivalent strength. See 98, *c*.

a. The alkaline earths baryta, strontia, &c. also restore the blue colour. To discover whether alkalies, or their carbonates, or alkaline earths have acted on the test, add sulphuric acid to the solution, the earths will be precipitated; but the alkalies will not.

79. MAGNESIA. Pure magnesia is a white powder, infusible by heat, and nearly insoluble in water. If laid on reddened litmus paper and moistened, it changes the colour to blue.

The following tests indicate magnesia.

Potash. A voluminous flocculent precipitate in neutral solutions. Muriate of ammonia may diminish or prevent this precipitate, according to quantity.

Ammonia. A bulky precipitate in neutral solutions, which entirely disappears on adding muriate of ammonia.

Carbonate of potash. The same. If muriate of ammonia be previously present, no precipitate occurs in this, or the last case. If the solution however be boiled, a precipitate occurs.

Phosphate of soda added to caustic, or carbonated ammonia produces a precipitate in neutral solutions.

Sulphuric acid *Hydrofluosilic acid* *Oxalic acid* *Binoxalate of potash* *Hydrosulphuret of ammonia* *Prussiate of potash.*	No precipitate.

a. Magnesia is precipitated from its solutions by the pure alkalies as a bulky hydrate, which is soluble in dilute sulphuric acid. This latter circumstance distinguishes magnesia from other alkaline earths, their sulphates being very sparingly soluble.

b. Magnesia in *neutral* solutions is distinguished from alkaline salts by its producing white precipitates with caustic ammonia, and carbonate of potash; and from solutions of baryta, stronia and lime by caustic ammonia, which does not precipitate those three earths.

c. Magnesia in *acid* solutions may be distinguished from the salts of potash, soda, or ammonia by producing a white precipitate with phosphate of soda after having been supersaturated with ammonia. From the salts of lithia, magnesia may be distinguished by giving a precipitate with an excess of potash, especially when the mixture is boiled. From baryta, and strontia, it may be distinguished by producing no precipitate with sulphuric acid; and from lime by its giving no precipitate with oxalic acid.

d. Suppose baryta, strontia, lime, and magnesia to be held together in solution, they may be thus distinguished: add ammonia; if the so-

lution is *neutral*, a white flocculent precipitate will fall, indicating magnesia. Filter the solution, and add hydrofluosilic acid; after some time a precipitate will be formed, indicating barytes. Filter, and to the remainder of the solution add water, diluting it largely; then add dilute sulphuric acid, and a precipitate will fall indicating strontian. After this has completely separated, to the clear solution add oxalate of ammonia, and a cloudiness will indicate the presence of lime. In this case all 4 substances are supposed to be present, but if the tests do not act, as above stated, the absence of that substance to which the test is appropriate is to be inferred, see 115, *b. c. d. e.* 44 *c.* and 75, *b.*

e. Lime and magnesia may be thus separated. To the solution add oxalate of ammonia, slightly acidulated with oxalic acid, collect the precipitate, wash, and dry it at 212.° 100 parts of the dry precipitate indicate 38 or 39 of lime. Another process is to add muriate of ammonia to a muriatic solution of lime and magnesia, and afterwards to add caustic ammonia slightly in excess; if necessary, filter. Then add oxalate of ammonia, and separate the oxalate of lime by filtration. Phosphate of soda, or phosphate of ammonia now added will precipitate the magnesia, as an ammonia magnesian phosphate, which dried at a heat of 100° probably consists of

Ammonia	1	......	17	......	14.41
Magnesia	1	......	20	......	16.96
Phosphoric acid	1	......	36	......	30.45
Water	5	......	45	......	38.18
	1	......	118	......	100.00

80. MAGNESIA, *carbonate of*, see 25, 65 *c.*

81. MANGANESE. Liquid potash, soda, or ammonia produces in a solution containing manganese a white precipitate, insoluble in an excess of the alkali, changing to brown, and at the point of contact with the atmosphere, to black. Carbonate of potash produces in solutions of proto-salts of manganese a white precipitate, which on exposure to the air, does not change colour, but remains white. Prussiate of potash produces a white or pale red precipitate which is soluble in free acids. Hydrosulphurets produce a white, grey, or reddish precipitate. Chloride of soda (common salt) dropt into a solution of protoxide of manganese produces a black bulky precipitate of deutoxide of manganese.

a. The following tests discriminate manganese more particularly.

PROTOXIDE.	DEUTOXIDE.
Potash produces a white precipitate, changing in air to yellowish, then brown and finally black.	*Potash.* In a muriatic solution a dark brown voluminous precipitate.
Ammonia; a white precipitate which in air soon turns brown and finally at the point of contact with the air black.	*Ammonia.* The same as potash.
Carbonate of potash; a white precipitate: not changing in air.	*Carbonate of potash.* The same as potash.
Carbonate of ammonia; the same as carb: potash.	*Carbonate of ammonia.* The same as potash.
Phosphate of soda, a white precipitate.	*Phosphate of soda,* in a neutral muriatic solution a light brown precipitate.
Oxalic acid, and oxalates, produce if the solution be concentrated, if it contain no muriate of ammonia, and it be not acid, crystals of oxalate of magnesia; ammonia added assists these tests.	*Oxàlic acid.* No precipitate but after a time it makes the solution colourless.
Prussiate of potash, a white or pale red precipitate soluble in free acids.	*Prussiate of potash,* a greyish green precipitate.
Hydrosulphuret of ammonia, in neutral solutions a yellowish or flesh red precipitate. In air it becomes oxidised and brownish black.	The same as the protoxide.
Liquid sulphuretted hydrogen, and sulphuretted hydrogen gas no precipitate in neutral solutions: if the solutions be made acid and a few drops of ammonia be added a pale flesh red precipitate occurs.	These tests produce a milk-white precipitate of sulphur and the deutoxide is reduced to protoxide.

b. The salts of manganese treated on charcoal with borax before the blow-pipe, produce a bead, which acquires in the outer flame an amethyst colour; but this colour disappears in the inner flame; it however may be made to re-appear by placing the bead again in the outer flame. *The smallest portion of manganese can be detected before the blow-pipe by fusing it, or its salt, with soda on platina foil: the melted mass exhibits a green colour in the outer flame.*

c. If a mineral substance is supposed to contain manganese, reduce it to powder, pour upon it muriatic acid, and apply a moderate heat. If chlorine gas should be abundantly produced the mineral is chiefly manganese, see 11 *c*, also 41 *a*.

82. **MERCURY.** This metal is acted on by a great number of tests. It may be detected by muriatic acid, which produces a white precipitate insoluble in simple acids; but rendered black on the addition of ammonia.

a. The following list shews the different colours or precipitates produced by the same test in solutions of the protoxide and peroxide of mercury.

PROTOXIDE.	PEROXIDE.
Potash. Black.	*Potash.* Reddish brown; added in larger quantity yellow: if much free acid, or if muriate of ammonia be present the precipitate is white.
Ammonia. Black.	*Ammonia.* White.
Carbonate of potash. Dirty yellow, which becomes black by boiling.	*Carbonate of potash.* Reddish brown. If muriate of ammonia be present, white.
Carbonate of ammonia, grey: but in larger quantity black.	*Carbonate of ammonia.* White.
Prussiate of potash. White gelatinous.	*Prussiate of potash.* White, changing after exposure to blue.
Iodide of potassium; greenish yellow; test added in larger quantity, the colour is blackish, excess of test dissolves the precipitate.	*Iodide of potassium.* A cinnabar red, soluble in excess of test: also in muriatic acid.

b. Silver and mercury precipitated, or held in separate solution may be thus distinguished from each other. If in solution, drop a very little of both solutions on different parts of a piece of clean copper: rub them with a clean finger; in each case a silvery whiteness will appear: but for the silver, its action will be more certain if it be rubbed with a little common salt and cream of tartar mixed together. Then apply heat to the copper: the mercury will be dissipated, but the silver will remain. If solutions of mercury and of silver be respectively precipitated by muriatic acid, ammonia turns black the mercurial precipitate, but dissolves the precipitate of silver.

c. Protosalts of mercury mixed with dry soda, placed in a glass tube closed at one end, and heated to redness by the blow-pipe are reduced, and the mercury sublimes in the form of a grey powder, which on being rubbed produces globules of metallic mercury.

d. Hydro-sulphurets, and sulphuretted hydrogen tarnish quicksilver; and turn its solutions black.

e. Pure protoxide of mercury is black: the peroxide is red, but when finely pulverized it becomes somewhat yellowish. A strong heat decomposes both into metallic mercury, and oxygen gas.

83. **MERCURY**, *protonitrate of*, made by dissolving mercury in nitric acid without heat, detects the following substances.

a. Uncombined ammonia, with which it produces an ash-grey, or black precipitate.

b. Muriatic acid, which gives a white precipitate insoluble but turning black, in ammonia.

c. Muriate of gold, which on adding the test gives a dense bluish black precipitate.

d. Muriate of platinum, producing an orange coloured precipitate.

e. Phosphoric acid;—a white precipitate is produced, soluble in an excess of the test, and also in nitric acid. In testing for phosphoric acid it is essential that no free alkali, or alkaline earth be present. See 17.

f. Sulphuric acid, indicated by a white crystalline or pulverulent precipitate that becomes yellow when repeatedly washed with boiling water.

84. **MERCURY**, *prussiate of*, or *cyanuret of*, is a delicate test for palladium, which it separates in the form of a yellowish white precipitate. See 95.

85. **MERCURY**, *permuriate*, *oxymuriate*, or *perchloride of*, may be detected thus. Place a drop of its solution on a piece of clean polished gold, and lightly rub the gold through the solution with the blunt point of a penknife; the part touched will become white. See 53, 82.

a. Lime water throws down a lemon yellow precipitate, more lime water produces a reddish yellow tint, a further quantity restores the lemon yellow colour. Caustic potash produces a yellow precipitate. Caustic ammonia causes a fine white flocculent precipitate which is a triple compound of ammonia, chlorine and mercury. Carbonate of potash gives a brick red precipitate of carbonate of mercury. Ferrocyanate of potash occasions a white precipitate of ferrocyanate of mercury, which gradually but slowly becomes yellowish and at length pale blue. Polished copper becomes tarnished, and if rubbed becomes of silvery whiteness. Solution of albumen causes a white precipitate soluble in excess of albumen.

b. Sulphuretted hydrogen gas precipitates the bi-sulphuret of mercury; if the solution is not very dilute a white or yellowish colour is produced before it becomes black. Hydriodate of potash causes a beautiful scarlet coloured precipitate of biniodide of mercury, which is soluble in an excess of the test. Protochloride of tin produces a white precipitate changing with more of the test to a greyish black; the solution must be excluded from the air, otherwise bichloride of tin is formed which does not act on the solution of corrosive sublimate.

c. Many of the foregoing tests acts on other solutions of mercury, besides the perchloride. See 82.

86. **MOLYBDENUM.** No acid but the nitric or nitro-muriatic acts on this metal, but several acids act on its oxide and afford blue solutions. Molybdic acid gives with nitrate of lead a white precipitate soluble in nitric acid; with the nitrates of mercury and silver a white flaky precipitate; with nitrate of copper a greenish precipitate, and it affords a white precipitate with neutral solutions of all the following tests; sulphate of zinc; muriates of bismuth, antimony, platinum and gold; and nitrate of nickel. Deutoxide salts of molybdenum are precipitated brown by alkalies and their carbonates, see the tables of re-agents.

a. There are two oxides of molybdenum; the protoxide, which is black, and the deutoxide, which is brown.

87. **MUCUS** *detected*; sub-acetate of lead instantly acts on animal mucilage, or mucus, and produces with it a copious white and flaky precipitate, but subacetate of lead is not rendered turbid by a solution of animal gelatine. This test acts on a variety of animal and vegetable matters, and is not therefore a distinctive test for mucus, but as mucus is not affected by tan the action of tan may serve to distinguish between mucus and gelatine, see 118.

88. **MURIATIC ACID, AND MURIATES,** *detected*, see 11, 83 *b*, and 108.

89. **NICKEL.** Pure oxide of nickel is dark grey: the hydrate is green. The solution is green. The following tests detect nickel. There are two oxides: the protoxide and the peroxide.

Potash, apple green precipitate.

Ammonia, in small quantity a green troubling; on adding a larger

quantity a fine blue colour inclining slightly to violet; after an hour or two the blue changes to violet or to an amethyst red. A solution of potash produces after adding the ammonia, an apple green precipitate.

Carbonate of potash, apple green precipitate.

Carbonate of ammonia, apple green precipitate, soluble in excess of this test and forming a bluish-green solution.

Phosphate of soda }
Prussiate of potash } White precipitate.

Oxalic acid, after some time a greenish precipitate.

Hydrosulphuret of ammonia, a black precipitate.

Liquid sulphuretted hydrogen, and sulphuretted hydrogen gas, blacken the solution, and after a very long time a small precipitate appears, but only in neutral solutions.

a. To distinguish salts of nickel from copper, see 51 *a*, from cobalt they may be known by their action with ammonia; and by potash on adding it to the ammoniacal solution, as mentioned above.

b. The soluble salts of nickel are distinguished by a beautiful emerald green colour, while the colour of the insoluble salts is usually light green, and in some cases leek green.

c. To separate nickel from copper and zinc, see 52; from bismuth 41 *a*.

d. A great number of non-volatile organic substances hinder the precipitation of the oxide of nickel by alkalies, but not by hydrosulphuret of ammonia.

e. Before the blow-pipe salts of nickel produce with borax, or microcosmic salt, a reddish coloured bead, which fades on cooling, and the colour often quite disappears when the bead is cold. With soda, on charcoal, they are reduced to a white metallic and magnetic powder.

90. NITRIC ACID AND NITRATES, detected, see 14.

91. NITROGEN liberated by nitric acid, see 13 *c*.

92. OPIUM detected, see 12.

93. OSMIUM. The solution of oxide of osmium is best detected by infusion of galls, which presently produces in it a purple colour that soon after changes to a deep vivid blue. With pure ammonia and with lime the solution of osmium changes to yellow, but it is not af-

fected by chalk, or by pure magnesia. The solution with lime gives a deep red precipitate with galls which turns blue by acids. Osmium heated in the air, and in distillation, has an odour somewhat like chlorine. If a very small piece of pure osmium be placed on a slip of platina foil near its edge, and be brought into the flame of burning spirits of wine, and be held so as to allow a portion of the flame to rise freely by the side of the platinum the flame becomes suddenly very brilliant just as if pure olefiant gas had been inflamed.

94. OXYGEN GAS in water detected, see 67.

95. PALLADIUM. Mercury, as well as protosulphate of iron throws down palladium in a metallic form: cyanuret of mercury separates it in the form of a yellowish white precipitate [cyanuret of palladium] but the solution of palladium must in this case be neutral. This precipitate detonates when heated. Palladium forms a red solution with nitric acid, and precipitates in a brown powder on adding protomuriate of tin; but if the solution be much diluted this re-agent produces a fine emerald green colour. Prussiate of potash produces an olive coloured precipitate; sulphuretted hydrogen a dark brown; and all the metals except gold, or silver, and platina precipitate metallic palladium. The alkalies occasion an orange coloured precipitate.

a. Almost all the salts of palladium are soluble in water, and the colour of the solutions is a fine red.

96. PLATINA. Platinum in solution which is generally brown, or yellowish brown is detected by muriate of ammonia, see 34, and by protomuriate of tin, which is a delicate test, and produces an orange coloured precipitate (Accum), see 122. Protochloride of tin communicates to solutions of chloride of platinum a deep reddish brown colour without producing a precipitate (Rose). Potash and ammonia and their carbonates produce yellow precipitates of chloride of the test and platinum. Prussiate of potash changes the colour from yellow to green

The following tests give further indications of platinum.

Potash and ammonia and their carbonates produce yellow precipitates as before mentioned, particularly when muriatic acid is added to the solution. These precipitates are not soluble in free acid; but those by potash and ammonia are soluble in an excess of those alkalies, when they are heated; and if the solution is afterwards supersaturated with muriatic acid a white precipitate is produced.

Phosphate of soda, oxalic acid, cyanuret of mercury, and protosulphate of iron produce no precipitate.

Hydrosulphuret of ammonia and sulphuretted hydrogen produce a brown, or brownish black precipitate. *Metallic zinc* precipitates platinum in the state of a black metallic powder.

a. Solutions of chloride of platinum do not affect litmus paper; but solutions of the oxide redden it.

b. Before the blow-pipe the compounds of platinum are completely reduced, and impart no colour to the fluxes.

c. Potash and ammonia discriminate platinum from all other substances; the solution should be acid.

d. If lime water be added to a neutral solution of platina, and it be exposed to the sun's rays, an instant copious white precipitate will occur; if the platina be in excess the precipitate will be pale yellow. A neutral solution of platina is decomposed by oxalic acid, as well as by the oxalates, in the sun's rays, with a copious disengagement of gas.

97. **PLATINA,** *muriate or chloride of,* is a valuable test for distinguishing the salts of potash from the salts of soda; it produces with all the salts of potash a yellow precipitate but it does not affect salts with a base of soda. It is essential when this test is used, that there be neither ammonia, nor excess of acid present in the solution, which should be somewhat concentrated. It is also a test for tin, see 121.

The action of this test with the salts of ammonia is the same as with salts of potash. See 28 *c*, and the next article.

98. **POTASH** *and its salts,* distinguished from soda and its salts; also from ammoniacal salts, see 28, 110 *a*. The best re-agents for detecting potash in solutions are the chloride of platinum, and tartaric acid. But as the chloride of platinum acts towards ammoniacal salts in the same manner as towards the salts of potash, the ammonia in solution, if any, must be first removed when testing for potash with this re-agent.

a. If a concentrated solution of sulphate of alumina be dropped into a salt of potash, octahedral crystals of alum will be soon deposited.

b. Salts of potash may be thus distinguished. Fuse before the blowpipe a little borax to which a small portion of oxide of nickel has been added. A yellowish glass is obtained. Fuse this yellowish bead with a little of the salt under examination and if it contain potash the bead will assume a bluish or violet colour.

c. The neutral phosphate, arseniate, borate and carbonate of potash, and the fluoride and sulphuret of potassium turn reddened litmus paper blue.

d. Pure carbonate of potash dissolves in twice its weight of cold water. Common carbonate of potash used as a test should first be examined; it may contain sulphate and muriate of potash, and siliceous and calcareous earths. Nitrate of silver, baryta, and oxalate of ammonia are proper tests to try it with, after saturating it with pure nitric acid. Potash also may be examined in the same way. A solution of pure potash will remain transparent on the addition of barytic water. Pure potash is apt to become carbonated by keeping even in glass stopt bottles.

99. POTASH, *prussiate, or ferro-prussiate; or ferro-cyanate of,* is a valuable test: it forms precipitates with most of the metals, and from the colour of the precipitate, the particular metal in many cases may be inferred. It is not affected by the alkalies. It is chiefly used for detecting iron with which it produces a blue colour. See the table of re-agents for its action with metals generally.

a. If ferrocyanate of potash diluted with water gives immediately a blue colour, or precipitate, with muriatic acid, it is not pure; and may afford fallacious results if so used as a test. Neither sulphuretted hydrogen, the hydrosulphurets, the alkalies, nor the tincture of galls produce any precipitate in solutions of this salt.

100. POTASH, *red ferrocyante of,* precipitates the protosalts of iron blue or green according to the quantity in solution: but does not precipitate the persalts of iron. It is a more delicate test for protoxide of iron than the common ferrocyanates.

a. This test precipitates the following metals, and gives the following coloured precipitates, viz.

Tin............	White.
Silver	Orange coloured.
Zinc...............	Do.
Nickel.......	Brown.
Bismuth.........	Do.
Titanium...........	Do.
Copper............	Dirty brown.
Cobalt and uranium.....	Different shades of reddish brown.
Mercury, protoxide, and peroxide.	Brown.

101. POTASH, *sulphate of,* acts as a test like sulphate of soda. see 112.

102. QUININE, *sulphate of,* if a solution containing this salt is acidulated with sulphuric acid, and solution of hydriodate of potash be added, a yellow precipitate will take place, which will gradually become of a greenish colour, and finally change to reddish brown.

a. Pure sulphate of quinine when deprived of its water of crystallization by a heat of 212° should lose only from 8 to 10 per cent of water. This salt is often adulterated by sugar, gum, starch, ammoniacal salts, and earthy salts as the sulphates of lime, and magnesia, and the acetate of lime. Gum and starch are left undissolved when the impure sulphate of quinine is digested in strong alcohol.

103. RESIN *is detected* by nitric acid. When concentrated nitric acid is repeatedly digested with gum, gluten, jelly, or other immediate vegetable products, it converts them partly into oxalic acid; but true resin suffers no such change, it merely becomes a pale, porous, orange coloured mass, see 1: 13 *a.*

104. RHODIUM. Pure metallic rhodium is not soluble in any of the acids, but in alloys it dissolves with other metals. With ammonia, potassa, soda, or muriate of platina it gives a yellow precipitate: and a brown precipitate with sulphuretted hydrogen and hydrosulphuret of ammonia. There are two oxides: the protoxide black, and the peroxide yellow. Henry says it is not precipitated by ferrocyanate of potassa, muriate of ammonia, hydrosulphuret of ammonia, nor by carbonated alkalies.

a. The salts of rhodium have as yet been but imperfectly examined: those containing the peroxide are mostly of a red, or orange colour; they are precipitated by cyanuret of mercury, by ferrocyanuret of potassium and by muriate of ammonia. The action of the pure alkalies on them is very indefinite. The perchloride of rhodium yields a difficultly soluble, dingy, yellow precipitate with excess of ammonia: muriatic acid redissolves it, and forms a red solution.

105. SILICA, is soluble in hydrofluoric acid, and forms silicated fluoric acid gas; it dissolves in no other acid after the silicate has been ignited. Before the blow-pipe silicic acid is best distinguished by its fusing into a perfectly clear bead with soda on charcoal; carbonic acid gas being at the same time disengaged with effervescence.

a. Of siliccous mineral 20 or 30 grains may be conveniently decomposed in the following manner. Prepare a leaden vessel of about 6 in-

ches in diameter and 3 inches deep—cover the bottom to the depth of ¼ of an inch with a paste of fluate of lime and sulphuric acid. Place in the vessel a shallow platina dish supported by leaden feet and spread thinly therein the siliceous matter to be acted on. Cover the vessel with a leaden lid and submit it to gentle heat, either in a sand bath, or over a lamp. The mineral will be decomposed in an hour or two. During the operation the powder must be moistened with a few drops of water; and when finished, concentrated sulphuric acid drop by drop must be added as long as any hydro-fluo-silicic acid is given off, using at the same time a gentle heat. Finally the sulphuric acid is to be driven off by continued heat and evaporation to dryness. The dry residue is then to be moistened with muriatic acid, and boiled in water.

b. Some silicates are soluble in concentrated muriatic acid and form a gelatinous mass; on adding water, the bases previously combined with the silicic acid, are dissolved in the state of metallic chlorides, and the free silicic acid remains in the form of delicate flocks. Other silicates which resist the action of acids, are converted into alkaline silicates soluble in water, by first fusing them with three times their weight of carbonate of potash in a silver crucible. The fixed mass being heated with concentrated muriatic acid, the silicic acid is precipitated as a jelly, and when well washed with water (which *may* dissolve it) and the water is evaporated, pure silicic acid remains in the form of a gritty white powder without smell or taste.

106. SILVER. *Muriatic acid free, or in combination, as in common salt, gives a white curdy precipitate in solutions of silver. This precipitate turns black in the sun; and is soluble in ammonia,* which distinguishes it from the precipitate given by muriatic acid in solutions of mercury or of lead. Iron, zinc, and copper precipitate silver from its solutions in a metallic state. The alkalies and their carbonates also act on silver, and so do several other tests, see 11 *a*, and 82 *b*. and table of re-agents.

a. Pure oxide of silver is a greyish brown powder, readily soluble in nitric, and some other acids. The following tests act on solutions of silver.

b. Potash and ammonia, and carbonate of potash, carbonate of ammonia and oxalic acid produce precipitates, all of which are soluble in ammonia. The colour of the first two is brown; of the three others white. Phosphate of soda and phosphoric acid give a yellow precipitate, also soluble in ammonia, but the solution when this test is used must be neutral. Hydrosulphurets and sulphuretted hydrogen produce black precipitates.

c. Metallic iron, copper, or zinc precipitates silver, metallic; near the zinc the silver is black, further from it white.

d. Muriatic acid and the chlorides give white curdy precipitates, when much silver is held in solution, but only an opalescence if it be in small quantity.

e. Protosulphate of iron precipitates silver in a white metallic state.

f. Before the blow-pipe salts of silver are reduced to the metallic state by fusion with soda on charcoal.

107. SILVER, *acetate of,* acts as a test precisely like the nitrate of silver; but it is sometimes more convenient to use it in analysis than the nitrate.

108. SILVER, *nitrate of,* is an excellent test for discovering muriatic acid, and chlorine, as well as muriates and chlorides. It produces with them white curdy precipitates that blacken in the sun, and that are soluble in ammonia. As this test is acted on by alkaline and earthy carbonates, and by sulphuric and sulphurous acids, and their combinations, these acids must be first removed by nitrate, or acetate of barytes, and the alkaline, or earthy carbonates, by fully saturating them with nitric acid. Carbonate of silver is soluble in dilute nitric acid with effervescence: the muriate or chloride of silver is not. See also 15 and 106, for other substances which act on solutions of silver.

a. With the assistance of an alkali, nitrate of silver is a test for detecting minute portions of arsenic, with which it produces a yellow precipitate, see 39. It likewise indicates minute portions of sulphuretted hydrogen, and hydrosulphurets in general, producing with them a black precipitate of sulphuret of silver. With chromic acid it yields a carmine red precipitate of chromate of silver. Vegetable extractive matter also acts on nitrate of silver; the precipitate is brown and dissolves in nitric acid.

b. Nitrate of silver detects hydro-cyanic acid with which it produces a white precipitate of cyanide of silver even in a very dilute solution of the acid. This precipitate is distinguished from other white precipitates of silver by its being insoluble in nitric acid at ordinary temperatures, but readily soluble at a boiling heat; and by its retaining its pure white colour when exposed to the rays of the sun, see 10. Cyanide of silver when dried and heated emits cyanogen gas which is easily known by the beautiful rose red colour of its flame.

c. Fused nitrate of silver may be contaminated as a test with copper, and perhaps with gold. But both are said to be precipitated on the caustic being dissolved in water. If nitrate of silver be made by

dissolving silver directly in nitric acid, the silver should be pure. Pure silver may be obtained by mixing carbonate of potash with precipitated muriate of silver, and melting the mixture in a strong heat. The result will be pure metallic silver. The muriate of silver before it is melted should be well washed with pure water.

109. SILVER, *sulphate of,* is used sometimes in analysis in preference to the acetate, or nitrate, but similar precautions should be adopted, as in using the nitrate of silver.

110. SODA and *its salts,* may be distinguished from potash and its salts by tartaric acid, and chloride of platinum, see 19, and 98. Salts of soda tinge the outer flame of the blow-pipe yellow, which is the best discriminative test.

a. Potash and soda may be very readily distinguished by the microscope thus. Add nitric acid and thus change the alkali into nitrate of soda, or nitrate of potash as the case may be. Spread a drop on a slip of clean glass and slowly evaporate it; place the glass under the microscope and if the base be soda, cubic or rhomboidal crystals will be seen, but if potash, needle-like crystals of saltpetre; the solution should not be too concentrated, nor the evaporation too rapid, or the crystals may become confused and irregular.

b. The solutions of the neutral phosphate, arsenite, borate, and carbonate of soda, and of fluoride and sulphuret of sodium, turn reddened litmus paper blue.

c. Carbonate of soda, used as a test, may be examined in the same manner as carbonate of potash, see 98 *d.*

111. SODA, *succinate of,* see 36.

112. SODA, *sulphate of,* or sulphate of potash detects lead. The precipitate, sulphate of lead, is insoluble in water and in liquid ammonia, but soluble in dilute nitric acid, when assisted with heat. The solution is blackened by sulphuretted hydrogen gas. These indications distinguish sulphate of lead from sulphate of barytes.

a. Sulphate of soda as a test should not contain an excess either of acid, or of alkali; both of which may be ascertained by blue, or reddened litmus; see 77, 78, nor should it contain earthy or metallic salts; the former of which are detected by carbonate of potash, and the latter by prussiate of potash. If it contains muriate of soda, it may be detected by sulphate of silver.

113. STARCH, see 63. When solutions of starch and iodine are added to each other, indigo-blue, reddish-blue, violet, or black, are the colours that may be produced; the colour depending on the quantities and proportions of the two substances.

a. Starch in solution is precipitated by subacetate of lead; and if boiled for a considerable time with sulphuric acid diluted with 12 parts of water, sugar is formed.

114. STEEL may be distinguished from iron thus: put on the article to be examined a drop of dilute nitric acid, and let it remain one or two minutes. If, on washing it off with water, a black spot is left, the article examined is steel; but iron if the spot be of a whitish grey colour.

115. STRONTIA, in a pure state resembles baryta in its properties. It is detected by sulphuric acid which produces a white precipitate, insoluble in diluted free acids. Even a small quantity of strontian salt produces a white precipitate with sulphuric acid; but the precipitate which does not form till after some time, is insoluble in diluted acid.

a. Either oxalic acid, or binoxalate of potash, troubles neutral solutions of strontian: if they are very dilute the opalescence does not occur immediately. The precipitate is instantly augmented by the addition of caustic ammonia.

b. Strontian salts may be distinguished from barytic salts by throwing them into alcohol and setting fire to it. They occasion a carmine red flame, particularly when stirred, and when the alcohol is nearly burnt away: baryta does not produce this coloured flame, see *g*.

c. Neutral succinate of ammonia produces an immediate precipitate in concentrated solutions of barytes; but none in concentrated neutral solutions of strontia, at least not until after some time. This test therefore distinguishes baryta from strontia.

d. M. Liebeg states that the iodate of soda is an excellent re-agent for separating barytes from strontia; the latter is not at all precipitated by it, while the former is completely thrown down in *neutral* solutions. The precipitate is flaky.

e. For discriminating strontia from lime, &c., see 72, and 79 *d*, from barytes, see 40 *d*, from lithia see, *g* in this article.

f. Hydro-fluo-silicic acid, hydrosulphuret of ammonia, prussiate of potash, and red prussiate of potash produce no precipitate in solutions of strontia.

g. Salts of strontia impart to the flame of the blow-pipe a bright carmine red colour, when fused on the platinum wire. Lithia does the

same, but strontia is distinguished from lithia by its giving a precipitate with the carbonated alkalies which lithia does not.

h. Strontia is found in nature always combined with an acid, see 39½, *c.*

115. SULPHURIC ACID: and *sulphates—Sulphuric acid, free or in combination is best detected by barytes,* see 40. To detect the presence of sulphuric acid in the sulphates which are either insoluble or very sparingly soluble both in water and in acids, such as the sulphates of barytes, strontian, lime, and protoxide of lead, it is necessary to boil the compound in a solution of carbonate of potash or of soda. The solution is filtered from the undissolved residue, and after being supersaturated with muriatic acid, is mixed with a solution of chloride of barium. This immediately produces a white precipitate of sulphate of barytes, provided the insoluble substance contained sulphuric acid.

a. Before the blow-pipe, sulphuric acid is detected in the sulphates, and especially in those which do not contain a metallic oxide, by the following experiment : a portion of the salt is added to a clear colourless bead formed by the fusion of soda with silica on charcoal, and the whole is heated in the inner flame. The colour of the bead is thereby rendered dark brown, or with small quantities and when it is cold red. When a sulphate is melted with soda, on charcoal, in the inner flame, and the mass is taken from the charcoal, laid on a bright piece of silver, and moistened with water the silver acquires a black or dark yellow stain.

b. The specific gravity of pure sulphuric acid should be 1.848 at 60° Fah. If it be heavier, there is reason to suspect the presence of some impurity. If a sediment occur on adding distilled water it contains sulphate of lead. If iron be present it may be detected by diluting the acid and adding a little carbonate of potash and then prussiate of potash, or tincture of galls, see 55. For detecting copper, test by ammonia, see 51.

c. All sulphates in solution may be decomposed by acetate of barytes ; see 40 *g.*

d. The sulphates are an important class of salts : the greater part are soluble in water. Insoluble sulphates may be mixed with 3 times their weight of carbonate of soda, and ignited ; they then form soluble sulphates of soda, and may be tested by barytes. The sulphates of potassa, soda, lithia, lime, baryta, and strontia resist a white heat without decomposition : the other sulphates evolve when heated intensely, sulphuric acid, sulphurous acid and oxygen. Many of them are decomposed at high temperatures by the action of hydrogen, which carries

off the oxygen of the acid, and of the base, and leaves a metallic sulphuret. They are all decomposed by charcoal at a red heat, and most of them are thus converted into sulphurets; carbonic acid, and carbonic oxide being at the same time evolved.

117. SULPHURETS. It is well known that certain oxides possess the property of precipitating others from their solutions, by combining with the acid of the dissolved oxide; and this process has been adopted for the separation of certain metallic oxides.

Metallic sulphurets, prepared in the usual way, may be employed in the same way as the oxides, for precipitating oxides from their solutions; the latter are then converted into sulphurets, whilst the metal of the sulphuret continues in the state of oxide with the acid, previously united with the metal precipitated; this action of the sulphurets frequently possesses advantages in chemical analysis.

The results obtained by employing eight metallic sulphurets will be stated; they were prepared either by precipitation with sulphuretted hydrogen or an alkaline hydrosulphate. In operating on the solution of a salt by a sulphuret, the sulphuret was always used in excess, and the mixture was exposed to a boiling heat for about a quarter of an hour.

Sulphuret of lead precipitates nitrate of silver, sesquichloride of iron, nitrate of copper; it does not precipitate nitrate of cobalt, nitrate of cadmium, nitrate of manganese, sulphate of nickel.

Sulphuret of cobalt precipitates acetate of lead, sesquichloride of iron, sulphate of cadmium, sulphate of copper, nitrate nickel, nitrate of silver; it does not precipitate sulphate of manganese.

Sulphuret of iron precipitates nitrate of lead, sulphate of cadmium, sulphate of copper, nitrate of silver; it does not precipitate nitrate of cobalt, sulphate of manganese, nitrate of nickel.

Sulphuret of cadmium precipitates nitrate of lead, sulphate of copper, nitrate of silver; it does not precipitate nitrate of cobalt, sesquichloride of iron, sulphate of manganese, nitrate of nickel.

Sulphuret of manganese precipitates acetate of lead, nitrate of cobalt, sesquichloride of iron, sulphate of cadmium, sulphate of copper, nitrate of nickel, nitrate of silver.

Sulphuret of copper precipitates nitrate of silver; it does not precipitate acetate of lead, nitrate of cobalt, sesquichloride of iron, sulphate of cadmium, sulphate of manganese, nitrate of nickel.

Sulphuret of nickel precipitates acetate of lead, sesquichloride of iron,

sulphate of cadmium, sulphate of copper, sulphate of silver; it does not precipitate nitrate of cobalt, sulphate of manganese.

Sulphuret of silver does not precipitate acetate of lead, nitrate of cobalt, sesquichloride of iron, sulphate of cadmium, sulphate of copper, sulphate of manganese, nitrate of nickel.

It will be observed on examination that sulphuret of manganese decomposes all the solutions of metallic oxides tried, while the sulphuret of silver did not decompose any one whatever; it results from these facts that if silver has the strongest and manganese the weakest affinity for sulphur, all the other metals are intermediate as to these, and arranged according to their degrees of affinity for sulphur; they stand thus: silver, copper, lead, cadmium, iron, nickel, cobalt, manganese.

The metals are here so arranged that any one of them in state of sulphuret does not act upon a solution of the metals following: thus for example, the sulphuret of nickel precipitates the salts of silver, copper, lead, cadmium and iron, but effects no change in those of cobalt and manganese.

There is only one exception, it is that the sulphuret of iron precipitates the nitrate of lead, whilst the sesquichloride and pernitrate of iron are only partially precipitated by the sulphuret of lead. *London and Ed. Journal,* Page 138. 1838.

Sulphurets, may be detected, some by fire which drives off the sulphur: and those soluble in water, by being treated with muriatic or sulphuric acid, which disengages sulphuretted hydrogen, and if the solution be not too dilute, effervescence occurs. This gas may be known by its smell, or by its tarnishing silver. Or the sulphuret may be pulverized and digested with strong nitric acid; this converts the sulphur into sulphuric acid, which may be detected by a solution of barytes, or of lead.

118. TAN, *or tannin* is employed for detecting animal gelatine, or jelly, with which it forms an elastic adhesive mass, that soon dries in the open air, and becomes converted into a brittle resinous-like substance, insoluble in water, and capable of resisting a great number of chemical re-agents. It resembles overtanned leather. Tan also acts on albumen, but the precipitate does not take place immediately:—with gelatine an immediate precipitate occurs. A solution of tan may be made by pouring hot water on bruised gall-nuts, or oak-bark, catechu, &c., and allowing the infusion to stand some time, filtering it when it becomes cold.

a. If corrosive sublimate does not act on the liquid under examination the absence of albumen may be inferred with certainty. Then

add the test, tan, till the whole of the gelatine be precipitated, but not in excess; the flocculent precipitate that occurs is a mixture of tan and gelatine, which if weighed and multiplied by 0·6 will very nearly give the true weight of the gelatine.

119. TELLURIUM. In a nitro-muriatic solution of this metal, water produces a white precipitate, which fuses at a white heat and sublimes. Tellurium is precipitated in a metallic state by sulphurous acid; by sulphate of ammonia; by iron, and by zinc. Tincture of galls produces a yellow flaky precipitate, and solutions of potash and soda white precipitates soluble in excess of the precipitant, see table of re-agents.

a. The oxide of tellurium forms salts with acids and alkalies: combines with hydrogen yielding a colourless gas absorbable by water, and forming a claret coloured solution, with an odour like sulphuretted hydrogen.

120. THORINA after ignition is insoluble in all acids except hot sulphuric acid diluted with an equal weight of water. It is precipitated white by ferrocyanate of potash, phosphate of soda, hydrosulphuret of ammonia, and by oxalic acid. It forms a colourless glass with borax, before the blow-pipe.

a. Solutions of thorina may be distinguished from alkalies, and from barytes, strontian, and lime, by giving a gelatinous precipitate with ammonia: from magnesia by its action with ammonia: and by hydrosulphuret of ammonia, which produces no precipitate with magnesia, but in neutral solutions of thorina it precipitates hydrate of thorina; and from solutions of alumina and glucina, by producing with a solution of potash, a precipitate which does not redissolve in an excess of the precipitant.

121. TIN is detected by muriate of gold, see 60. Muriate of platina produces in solutions of tin an orange coloured precipitate; ferrocyanate of potash, a white precipitate; perchloride of mercury black, with protoxide salts, but white with the peroxide: and a plate or slip of lead, metallic tin. See table of re-agents

a. A slip of tin immersed in a muriatic solution of gold becomes covered with a purple powder which gradually diffuses throughout the fluid, and imparts to it the colour of red wine, but the colouring matter soon precipitates.

b. A bar of metallic zinc precipitates tin from the solutions of its protosalts in the metallic state in the form of small greyish-white span-

gles; but in solutions of persalts of tin, it disengages hydrogen gas, and causes a white gelatinous precipitate of peroxide of tin.

c. *Before the blow-pipe, salts of tin are easily discriminated by producing a button of metallic tin. They should be added to a little soda on charcoal and be submitted to the inner flame.*

d. Proto-salts of tin are easily recognized by their action with the solution of gold, see 59; and 60, the persalts may be distinguished by giving with hydrosulphuret of ammonia a yellow precipitate which is completely soluble in excess of the precipitant, and with liquid sulphuretted hydrogen, or a current of sulphuretted hydrogen gas; but in these cases the yellow precipitate does not take place immediately.

e. Nitric acid precipitates tin in the state of pure oxide.

f. In an acid solution of antimony and tin with the assistance of a vapour bath heat, the antimony may be precipitated by immersing a plate of tin and keeping the solution acid. The antimony should be well washed and dried before it is weighed.

122. TIN, *proto-muriate of,* is a delicate test for platinum, with the solutions of which it produces an orange coloured precipitate. See 96. It also detects gold producing a purple precipitate. See 59 and 60. With the neutral salts of palladium this test gives a dark brown precipitate, but if added in excess, the liquor remains of a fine transparent emerald green colour. With a solution of corrosive sublimate it produces a dark brown precipitate. The proto-nitrate of tin is said to be a more delicate test than the proto-muriate; it yields with solutions of silver; platina, palladium, and tellurium precipitates similar to that produced in a solution of gold.

a. This test is best when fresh made: it is apt to acquire a further portion of oxygen from the atmosphere, and become a permuriate which does not act like the proto-muriate. It should be kept in well stopt bottles.

b. Proto-muriate of tin reduces iron to a minimum of oxidation in those compounds in which the metal is peroxidized: thus red sulphate of iron is reduced by it to the green. It blackens the solution of corrosive sublimate.

123. TITANIUM, is precipitated from solutions in which it exists as titanic acid, by ammonia, which gives a bulky precipitate similar to that of alumina. Titanic acid is also precipitated but not com-

pletely by boiling. Infusion of gall-nuts precipitates it orange red: ferrocyanates, brown; and metallic zinc produces a purple powder if the solution be nearly neutral. Chemists are still far from being able to separate titanic acid with accuracy from all other substances.

a. The carbonated alkalies also precipitate titanium; and if prussiate of potash gives a green colour it is, according to Lowitz, owing to the presence of iron: an alkali dropped in after this test, produces a purple precipitate, becoming blue and eventually, white. Zinc immersed in weak solutions of titanium changes their colour from yellow to violet, and ultimately to an indigo; tin produces in them a pale red tint which deepens to a bright purple red. Hydrosulphuret of potash throws down a brownish red or according to others a dirty grass green precipitate. Salts of titanium in solution are not decomposed by sulphuretted hydrogen.

124. TUNGSTEN. Caustic or carbonated alkali produces in solutions of tungsten white precipitates; prussiate of potash dirty yellow, and tincture of galls brownish red. Sulphuretted hydrogen produces no precipitate.

a. Tungsten has a greyish white colour like that of iron, and a good deal of brilliancy. It is not magnetic. It is extremely hard and brittle, and requires, a heat of 170° Wedgewood to melt it.

125. URANIUM. A solution of uranium in nitric acid is yellow, or inclining to yellow, and by proper evaporation crystals of a citron yellow colour may be separated. In such solution the alkalies produce a pale green or yellow precipitate insoluble in an excess of alkali; ferrocyanate of potash a blood red precipitate; iron, no precipitate. The proto-salts of uranium are of a pale green or yellow colour, and are not precipitated by carbonate of potash; Thomson says they are precipitated by alkaline carbonates; but the precipitate is soluble in an excess of the precipitant: the peroxide is of an orange colour; nut galls produce a chocolate coloured precipitate.

a. No precipitate is produced in solutions of uranium by zinc, iron, or tin.

126. VANADIUM. The salts of vanadium are generally of a fine blue colour. Carbonated alkalies turn the solution brown. Muriatic solution of vanadium is orange red, with borax vanadium forms before

the blow-pipe a fine green glass, which appears brown when hot, and when tin is added the colour becomes blue.

127. YTTRIA. Pure hydrate of yttria has a white colour which ignition turns dirty yellow. It easily dissolves in acids, forming salts having a sweet astringent taste. The following tests indicate yttria.

Potash
Ammonia } White voluminous precipitate insoluble in excess.

Carbonate of potass
Carbonate of ammonia } Do. soluble in excess.

Phosphate of soda
Oxalic acid } Do. soluble in muriatic acid.

Hydrosulphuret ammonia, a precipitate of yttria.

Liquid sulphuretted hydrogen
Sulphuretted hydrogen gas. } No precipitate.

Prussiate potass, white chalky precipitate.

a. The solutions of the neutral salts of yttria redden litmus paper.

b. Solutions of yttria are distinguished from solutions of alkalies, barytes, strontian, lime, and magnesia, in the same manner as solutions of alumina are distinguished from those substances. From solutions of alumina and glucina, those of yttria are distinguished by producing with a solution of potash, a precipitate which does not redissolve in an excess of potash. Yttria and thorina are distinguished by the double salt produced by sulphate of potash, which if it contain thorina, is insoluble in a saturated solution of sulphate of potash, but soluble if it contain yttria.

c. Yttria precipitates glucina, zirconia and alumina.

128. ZINC. Pure oxide of zinc is white. When heated it becomes of a lemon yellow colour, but regains its whiteness when cold. It is not volatilized by heat and readily dissolves in acids. Zinc may be detected by the following tests.

Potash, ammonia, and carbonate of ammonia produce a white gelatinous precipitate soluble in excess of the precipitant.

Carbonate of potash. White precipitate insoluble in excess of precipitant, but soluble in potash or ammonia. If muriate of ammonia be

present, this test produces no effect in the cold, but if boiled till the ammoniacal salt be decomposed a precipitate falls.

Phosphate of soda in neutral solutions, a white precipitate soluble in acids, potash and ammonia.

Oxalic acid. In dilute solutions, a troubling. In stronger solutions, if neutral, a white precipitate, soluble in potash, ammonia and acids.

Prussiate potash white gelatinous precipitate, insoluble in free muriatic acid.

Red prussiate potash yellowish red precipitate, soluble in free muriatic acid.

Hydrosulphuret of ammonia. White precipitate of sulphuret of zinc. If iron be present the precipitate may be grey, or black.

Liquid sulphuretted hydrogen, and sulphuretted hydrogen gas, a white precipitate in neutral solutions.

a. The solutions of the neutral zinc salts redden litmus paper.

b. A white precipitate produced by hydrosulphuret of ammonia in a clear and strongly alkaline solution can consist of nothing else than sulphuret of zinc (Rose).

c. Before the blow-pipe the salts of zinc are peculiarly easy of detection. If heated on charcoal with soda in the interior flame they spread on the charcoal a white coat of oxide of zinc. Moistened with nitrate of cobalt, and heated in the blow-pipe flame, they assume a fine green colour. With borax, or with microcosmic salt, oxide of zinc melts into a clear glass, which flaming renders milky.

d. Metallic zinc is employed as a re-agent for separating copper, lead, tin, silver, and tellurium in a metallic state from their solutions in acids. The solution should be somewhat acid.

e. To distinguish sulphate of zinc (white vitriol) from sulphate of magnesia (epsom salts) a mixture which professor O'Shaughnessy found to have been sold in the Calcutta bazar, add to each of the solutions a few drops of ammonia. Place a little of the precipitate on a piece of red hot charcoal, and urge the heat with a blow-pipe. The zinc will appear of a splendid yellow colour; but the magnesia will retain its whiteness.

f. To separate zinc from copper and nickel, see 52.

g. Zinc in solution may be distinguished from alkalies by its behaviour with carbonate of potash. And from earthy salts by its giving a white precipitate with hydrosulphuret of ammonia.

129. ZIRCONIA. The hydrate of zirconia, like that of alumina forms a pale yellow horny mass easily soluble in acids, particularly with heat. Ignited hydrate of zirconia is insoluble in most acids: but if digested a considerable time in sulphuric acid, it becomes soluble in boiling water.

Potash. *Ammonia.* *Carbonate of potash.* *Carbonate of ammonia.*	Produce a voluminous precipitate insoluble in an excess of the precipitant. The carbonates, however, if greatly in excess dissolve a portion of it.
Phosphate of soda. *Oxalic acid.*	A voluminous precipitate.
Sulphate of potash.	After a short time, a white precipitate soluble in a large quantity of muriatic acid.
Prussiate of potash.	A white precipitate.
Hydrosulphuret of ammonia.	A precipitate of zirconia.
Liquid sulphuretted hydrogen. *Sulphuretted hydrogen gas.*	No precipitate.

a. The neutral solutions of zirconia redden litmus paper.

b. Solutions of zirconia are distinguished from solutions of alkalies, barytes, strontian, lime, and magnesia, in the same manner as solutions of alumina are distinguished from those substances. From alumina and glucina, zirconia is distinguished by its insolubility in an excess of potash. From thorina and yttria, by giving with a solution of sulphate of potash, when heated, a precipitate which is nearly insoluble, not only in water but in acids; while the precipitates produced by sulphate of potash in solutions of thorina and yttria, can be dissolved by a large quantity of water. Zirconia is also distinguished from yttria by being rendered insoluble in acids (with the exception of sulphuric acid) by ignition, whereas the ignited yttria dissolves pretty easily in muriatic acid. Finally, it is distinguished from protoxide of cerium by not acquiring the red colour of peroxide of cerium on exposure to heat, and by not producing when fused with borax or microcosmic salt before the blow-pipe, a coloured bead, either before or after cooling, provided the zirconia has been completely freed from iron.

TABLE OF RE-AGENTS: COMPILED FROM BRANDE.

Metal.	Solution.	Infusion of Galls.	Prussiate Potash.	Hydro: Sulp. Ammonia.
Antimony	Tartrate of antimony & potassa	Straw colour, white	....	Bright orange
Arsenic	White oxide	But little change	....	Yellow
Arsenic.......	Arsenic acid	....	....	Do.
Bismuth......	Tartrate bismuth and potassa	Copious yellow orange	....	Deep brown
Cadmium.	Chloride	....	White	Yellow
Cerium..	Sulphate	Yellow	White	Proto salts, white
Cobalt........	Chloride	Yellow, white	Pale green	Copious black
Copper........	Proto chloride	Yellow, brown	Lilac	Brown
Copper...... ..	Nitrate	Green, gray	Deep brown	Brown and black
Gold..........	Muriate	Brown	Green	Yellow
Iron.	Neutral sulphate	Purple	White pale blue	Black, abundant
Iron..........	Per sulphate	Black, blue black	....	
Iron..........	Per muriate	....	Prussian blue	Black, abundant
Lead.........	Nitrate	Dingy yellow	White	Brown and black
Manganese....	Neutral muriate	Dirty yellow	White	Copious yellow
Mercury......	Acid nitrate	Yellow	Greenish white	Black
Mercury......	Do.	Do.	Do.	Do.
Mercury......	Corro: sublimate	....	White	Do.
Molybdenum..	Chloride	Brown	....	
Nickel........	Sulphate	Yellow green	Gray	Black
Osmium...... ..	Aq: sol: oxide	Bluish purple	....	Metallic
Palladium	Muriate	....	Olive	Brown
Platinum.	Chloride	Brownish green	Yellow	Pale brown
Silver....	Nitrate	Curdy brown, dirty yellow.	Cream colour	Brown
Tellurium.....	Chloride	Yellow	....	
Tellurium.....	Sulphate	....	....	Black
Tin......... ..	Acid chloride	Straw colour, yellowish	White then yellow and bluish	Deep orange
Tin...........	Acid per chloride	Fawn, colour do.	Pale yellow	Apple green
Titanium......	Acid muriate	Brown red: blood red	Deep blue (from acid)	Black
Titanium......	Neut: sulphate	Blood red	Sap green	Green
Uranium	Sulphate	Dark brown; reddish	Deep brown	Blackish brown
Zinc	Acid chloride	Dirty yellow	Yellowish white	Straw copious

TABLE OF RE-AGENTS.

To be used in conjunction with the foregoing Alphabetical List of Tests.

1 Ammonia.	10 Muriatic acid.	19 Potash, iodide.
2 ,, carbonate.	11 Muriates.	20 ,, prussiate.
3 ,, hydrosulphuret.	12 Oxalic acid.	21 ,, red prussiate.
4 Copper, metallic.	13 Oxalates.	22 Soda, phosphate.
5 Galls, tincture.	14 Potash.	23 Sulphuric acid.
6 Iron, metallic.	15 ,, carbonate.	24 Sulphates.
7 ,, protosulphate.	16 ,, chromate.	25 Sulphuretted hydrogen.
8 Mercury cyanuret.	17 ,, bi-carbonate.	26 Tin, proto-muriate.
9 ,, protonitrate.	18 ,, bin-oxalate.	27 Zinc, metallic.

ALUMINA—Numbers 1, 2, 3, 14, 15, 17, 22 of the above tests produce a voluminous precipitate. 12, 20, 21 and 25 produce no precipitate.

ANTIMONY—1, 2, 12, 14, 15, 17, 20, 22 produce white precipitates, 3,25 produce a red, or orange precipitate, 27 precipitates metallic antimony in a black powder.

ARSENIC—25, produces a bright yellow precipitate; but see the article No. 39, in the foregoing dictionary of tests.

BARYTA—2, 15, 22, 23, 24 produce a white precipitate ; 14 and 17 also if the solution is concentrated. 1, 3, 20, 21 produce no precipitate, neither does 12, but if the solution be very concentrated a precipitate appears after some time.

BISMUTH—1, 2, 14, 15, 17, 20, 22 white precipitates—16, 21, yellow precipitates—3, 25 black precipitates —19, brown precipitate—12 crystalline precipitate after some time—27 metallic precipitate of black powder—5 produces an orange precipitate.

CADMIUM—1, 2, 12, 14, 15, 17, 22 produce white precipitates. 20 white passing into faint yellow. 3, 21, 25 yellow precipitate. 27, metallic precipitate of small glancing grey spangles, or dendritical leaves.

CERIUM—1, 2, 3, 12, 14, 15, 17, 20, 22 produce white precipitates. 21, 25 produce no precipitate. Hydrosulphurets produce a brown precipitate becoming deep green. Accum.

CHROMIUM—1, greyish blue precipitate. 2, 3, 14, 15, 17, 22 light green precipitates. 16 deep brownish yellow precipitate. 25 no precipitate. 12, 20, 21 no precipitate. 5 brown precipitate. (Prussiates, green precipitates, Accum).

TABLE OF RE-AGENTS.

1 Ammonia.	6 Iron, metallic.	11 Muriates.
2 ,, carbonate.	7 ,, protosulphate.	12 Oxalic acid.
3 ,, hydrosulphuret.	8 Mercury cyanuret.	13 Oxalates.
4 Copper, metallic.	9 ,, protonitrate.	14 Potash.
5 Galls, tincture.	10 Muriatic acid.	15 ,, carbonate.

Cobalt—1, gives a blue precipitate, added in larger quantity a green precipitate. 2 red precipitate. 3 black precipitate. 14 blue precipitate turning green if allowed to repose, and dirty pale red when boiled. 15 red precipitate which on boiling becomes blue. 17 red precipitate. 20 green precipitate, turning grey. 21 dark reddish brown precipitate. 5 yellowish white precipitate.

Columbium—3, produces a chocolate precipitate. 5 orange precipitate. 20 olive precipitate. The recently prepared oxide is soluble in tartaric, citric, or oxalic acid.

Copper—*deutoxide* of, 1, 2, 14, 15 produce a blue precipitate. 14, 15 produce if the solution be boiled a dense black precipitate. 12, 22 a greenish white precipitate. 20 a reddish brown precipitate. 21 yellowish green precipitate. 3, 25 black precipitate, but if in small quantity a dark brown precipitate. 6 produces a precipitate of metallic copper. 27 black precipitate.

Glucina—1, 2, 3, 14, 15, 22 produce a voluminous precipitate. 12, 20, 21, 25 do not produce precipitates.

Gold—1, 2, produce yellow precipitates. 8, 15, 17, 21 produce no precipitate. 14 at first no action, afterwards green colour, and small black precipitate. 12 produces a dark greenish black colour. 20 emerald green or greenish black. 9, 25 black precipitates. 3, 27 produce brown precipitates. 26 reddish purple precipitate. 7 dark brown precipitate, but if the solution be very dilute only a blue colouring, and afterwards a brown precipitate.

Iridium—5, 20 instantly destroy the red colour of the solution. 1, 14, produce yellow precipitates.

Iron—*protoxide*, 1, 2, 14, 15 act much alike, viz. producing a white precipitate changing to green. 17 white. 22 white, changing to green on exposure to the air. 12, 18 yellow. 20 blue. 22 immediate dark blue precipitate. 3 black precipitate. 25 no precipitate. 5 black colour.

TABLE OF RE-AGENTS.

16 Potash, chromate.	20 Potash, prussiate.	24 Sulphates.
17 ,, bi-carbonate.	21 ,, red prussiate.	25 Sulphuretted hydrogen.
18 ,, bin-oxalate.	22 Soda phosphate.	26 Tin, proto-muriate.
19 ,, iodide.	23 Sulphuric acid.	27 Zinc, metallic.

IRON—*peroxide*. 1, 2, 14, 15, 17 cause reddish brown precipitates. 3 black precipitate. 25 milky white. 20 immediate dark blue. 21 no precipitate. 22 white precipitate.

LEAD—1, 2, 5, 10, 12, 14, 15, 17, 20, 22, 23, 24 produce a white precipitate. 3, 25 give black precipitates. 27 metallic precipitate in the form of blackish grey shining spangles. 16, 19 produce a yellow precipitate; the precipitate by 16 when digested in caustic alkali assumes a fine scarlet colour.

LIME—1, 2, 14, 15, 17, 22 act the same as they do on barytes. See Barytes in this table. 12, 13 produce a white precipitate; 23, 24 also produce a white precipitate, but the solution must be concentrated, and not dilute. 3, 20, 21 produce no precipitate.

LITHIA—22, if ammonia be added, produces a white precipitate; 12, no precipitate.

MAGNESIA—1, 15 produce a bulky precipitate, soluble in muriate of ammonia; 14 produces a voluminous flocculent precipitate. 2, 3, 13, 17, 20, 21, 23 produce no precipitate.

MANGANESE—*protoxide*. 1, 14 white precipitates changing to brown and black. 2, 15, 22 white precipitate not altered by exposure to air. 3 yellowish red precipitate. 20 white or pale red precipitate. 21 brown precipitate.

deutoxide. 1, 2, 14, 15, 17, 22 brown precipitates. 20 greyish green precipitate. 25 milk white precipitate.

MERCURY—*protoxide*. 1, 3, 14, 25 produce a black precipitate. 17 white precipitate, turning black on boiling. 10, 12, 20, 22 white precipitates. 19 greenish yellow precipitate. 16 red precipitate, *peroxide;* 1, 2, 12, 22 white precipitates. 14, 21 yellow precipitates. 3, 25 black precipitates. 19 cinnabar red precipitate. 20 white changing to blue.

MOLYBDENUM—(The molybdates of potassa and soda give a precipitate with almost every metallic solution). 9 gives a white precipitate in solutions of molybdenum, so do the muriates of zinc, and manganese. The muriate of cobalt gives a rose coloured precipitate, and 26 a blue precipitate. 5 produces a bright yellow colour and 20 a dark brown precipitate.

TABLE OF RE-AGENTS.

1 Ammonia.	6 Iron, metallic.	11 Muriates.
2 ,, carbonate.	7 ,, protosulphate.	12 Oxalic acid.
3 ,, hydrosulphuret.	8 Mercury cyanuret.	13 Oxalates.
4 Copper, metallic.	9 ,, protonitrate.	14 Potash.
5 Galls, tincture.	10 Muriatic acid.	15 ,, carbonate.

Nickel—2, 14, 15, 17 apple-green precipitates. 12 no immediate precipitate, but after some time a greenish precipitate. 20 white precipitate tending to green. 3 black precipitate. 25 after a time solution blackens.

Osmium—5 purple changing to deep blue. 3 yellow. Solution of lime and of carbonate of soda produce a yellow colour:—solutions of lead, yellowish brown.

Palladium—7 precipitates metallic palladium. 8 bright yellow precipitate, but not immediately. 20 olive. 25 dark brown. 26 brown precipitate in nitric solution.

Platinum—1, 2, 14, 15, 17 cause yellow precipitates. 7, 8, 12, 22 produce no precipitate. 26 deep reddish brown colour. 19 the same with a precipitate. 3, 25 brownish black precipitate, but 25 not immediately. 27 metallic platinum in black powder 20 changes solution from yellow to green.

Rhodium—1, 14 yellow. Muriate of platina gives a yellow precipitate. Alcohol and water a rose red colour. 3, 25 brown precipitate.

Silver—1, 14 brown precipitate. 2, 7, 10, 11, 12, 15, 17, 20, 26 produce white precipitates. 22 yellow. 19 white inclining to yellow. 21 reddish brown. 3, 25 black precipitates. 4, 6, 27 precipitate oxide of silver.

Tellurium—is soluble in the nitric, nitro-muriatic and sulphuric acids. The nitric solution is permanent when diluted: but the nitro-muriatic lets fall a submuriate on the addition of distilled water. The sulphuric solution is of a deep blue or purple colour. Heat precipitates the metal white; but if diluted with water, black. 5 produces a flaky yellow precipitate.

Tin—*protoxide.* 1, 2, 12, 14, 15, 17, 21, 22 cause white precipitates; 20 white gelatinous precipitate. 19 white flocculent precipitate inclining to yellow or red. 3, 25 yield dark brown precipitates. 27 metallic tin in the form of small greyish white spangles.

TABLE OF RE-AGENTS.

16 Potash, chromate.	20 Potash, prussiate.	24 Sulphates.
17 ,, bi-carbonate.	21 ,, red prussiate	25 Sulphuretted hydrogen.
18 ,, bin-oxalate.	22 Soda, phosphate.	26 Tin, proto-muriate.
19 ,, iodide.	23 Sulphuric acid.	27 Zinc, metallic.

TIN—*peroxide*. 1, 2, 14, 15, 17, 22 occasion white precipitates. 12 19, 21 no precipitate. 3 yellow precipitate if solution be neutral. 25 yellow precipitate, but not immediately. 27 a white gelatinous precipitate.

TITANIUM—1, 14 give white precipitates. 3, 20 green precipitates. 5 brownish red precipitate.

THORINA—1, 2, 3, 14, 15 produce precipitates. 12, 20 produce a white heavy precipitate. 22 white flocky precipitate. 21, 25 produce no precipitate.

TUNGSTEN—1, 2, 14, 15 white precipitate. 5 brownish red. 20 dirty yellow. 25 no precipitate.

URANIUM—1, 14 cause yellow precipitates. 3 dark brown. 20 fine brown. Hydriodric acid, yellow. 5 chocolate brown precipitate in neutral solutions. No precipitate by zinc, iron or tin.

YTTRIA—1, 2, 12, 14, 15, 17, 20, 22 all produce a white precipitate. 21, 25 produce no precipitate.

ZINC—1, 2, 3, 12, 14, 15, 17, 20, 22 produce white precipitates, some of which are gelatinous. 25 produces a white precipitate in neutral, but not in acid solutions. 21 yellowish red precipitate. 5 no precipitate.

ZIRCONIA—1, 2, 3, 12, 14, 15, 17, 20, 22 produce voluminous precipitates. 21 and 25 produce no precipitate.

TABLE OF RE-AGENTS. TO BE USED IN CONJUNCTION

	Ammonia	Carbonate Ammonia	Hydrosulph: Ammonia	Tincture Galls
1 Antimony.....	White	White	Red, orange	White, straw colr
2 Arsenic.......	....	....	Yellow	....
3 Bismuth.......	White	White	Black, brown	Red, yellow orange
4 Cadmium......	White	White	Yellow	None
5 Cerium........	White	White	White	Yellowish
6 Chromium....	Grey, violet	Light green	Light green	Brown
7 Cobalt........	Blue, green	Red	Black	Whitish
8 Columbium....	....	....	Light brown	Red
9 Copper........	Blue	Blue	Black, brown	Brown, Green
10 Glucina........	Voluminous	Voluminous	Glucina	....
11 Gold...........	Yellow	Yellow	Dark brown	Green, brown
12 Iridium.......	Yellow	....	....	Color discharged
13 Iron protoxide.	Flocky white chg. brown§	White	Black	Purple
14 Iron peroxide..	Brown	Brown	Black	Purple
15 Lead..........	White	White	Black	White, yellowis
16 Manganese, ox:	White chg. black	White	Yellowish, red	Dirty yellow,
17 Deutoxide	Brown	Brown	Yellowish, red	....
18 Mercury oxide.	Black	Black	Black	Orange, yellow
19 Peroxide......	White	White	Black	Yellow
20 Molybdenum...	....	....	....	Brown
21 Nickel	Blue	Green	Black, yel. green	Grey, green*
22 Osmium	....	....	Yellow, metallic	Blue purple.
23 Palladium	Orange	....	Brown	....
24 Platinum......	Yellow	Yellow	Brown	Green, brownish
25 Silver........	Brown, dissolves	White	Black, brown	Yellowish brow
26 Tellurium.....	....	....	....	Yellow
27 Tin, protoxide.	White	White	Brown, orange	Straw colour
28 Tin peroxide..	White	White	Yellow, green	Yellowish fawn
29 Titanium......	....	....	Black or green	Red, brown
30 Thorina.......	Gelatinous	Precipitate	Hydrate	....
31 Uranium.......	Yellow	White	Blackish brown	Chocolate
32 Yttria	White††	White††	Yttria	....
33 Zinc..........	White gelatinous	White	White	Yellowish
34 Zirconia	Voluminous	Voluminous	Voluminous	....

§ Chg: means changing. †† Voluminous. * No change (Henry)

Note.—Prussiate of potash is represented to turn solutions of titanium green, red

This remark is applicabl

WITH THE FOREGOING ALPHABETICAL LIST OF TESTS.

	Oxalic Acid	Potash.	Carbonate of Potash.	Prussiate of Potash.	Phosphate of Soda.	Sulphttd: Hydrogen.
1	White	White	White	White	White	Red, orange
2	....	....	....	.. ..	....	Yellow
3	Crystals	White	White	White	White	Black, brown
4	White	White	White	White	White	Yellow
5	White	White	White	White	White	
6	Red, green	Light green	Light green	Green	Light green	
7	White, red	Blue	Red	Green	Blue	Black
8	....	....	....	Olive	....	
9	Greenish white	Blue	Blue	Brown, reddish	Greenish white	Black, brown
10	....	Voluminous	Voluminous	. ...	Voluminous	
11	Gold, green...	Green, black	....	Green,	....	Black metallic
12	....	Yellow	....	Colour flies	White, changing green	
13	Yellow crystals	Flocky, white chg. brown	White	Blue, white	White	White
14	Yellow	Brown	Brown	Blue	White	Black
15	White	White	White	White	White	Pale red
16	Crystals	White changing black	White	White, pale red	Brown	White
17	....	Brown	Brown	Green	White	Black
18	White	Black	Yellowish	White, greenish	White	
19	White	Yellow	Brown	White, greenish	....	Black
20	Dark grey	....	....	....	White, greenish	Blackish
21	Greenish white	Green	Green	White, green	....	Metallic
22	....	....	....	....	....	Brown
23	....	Orange	....	Olive, orange	....	Brown
24	....	Yellow	Yellow	Yellow, (none)	Yellow	Black metallic
25	White	Brown	White	Whitish colour	....	Black
26	....	....	....	....	White	Brown
27	White	White	White	White yellow	White	Yellow
28	....	White	White	Gelatinous	....	None
29	Curdy hydrate†	....	....	Green, red, brown, blue	White flocky	
30	White heavy	Gelatinous	Precipitate	White heavy		
31	Precipitate	Yellow	White	Red, brown	....	Brown
32	White	White††	White††	White	White	
33	White	White	White	Gelatinous	White	White
34	Voluminous	Voluminous	Voluminous	White	Voluminous	

† Solution must be hot. †† Voluminous.

brown, and blue. A sufficient variety; but so, different authorities say the test acts likewise to other cases.

TESTING BY THE BLOW-PIPE.

Abbreviations. P. means platina P. w. platina wire. P. fo: platina foil

Substance.	On Platina.	On Charcoal.	With Soda.
1 Alumina........	No change	No change	Swells: infusible
2 Antimony, *oxide*	Fuses readily, sublimes in white fumes: *precipitated* oxide burns like tinder into antimonious acid.	Is reduced	P: w: fuses into a clear colourless glass which becomes white on cooling
3 Baryta.........	Infusible	Infusible	On ch. the hydrate & carbonate fuse and are absorbed
,, Hydrate...	Bubbles: fuses	Is absorbed	
,, Carbonate..	Fuses readily into a glass enamel white when cold.	Effervesces becomes caustic and is absorbed	
4 Bismuth........	.... (Oxide) fuses readily, mass dark brown: yellowish on cooling. In very intense heat reduces and perforates the foil.	Flies off in fumes leaving a mark with red, or orange edges, which may be dissipated in R. f. without colouring the flame. Oxide, instantly reduced	————
5 Cadmium, *oxide.*	No change	Soon dissipates; leaves a red or orange yellow powder on the ch.	On p: w: not fused on ch. reduced; sublimes and leaves a circular yellowish mark.
6 Cerium, *oxide*...	Oxide becomes peroxide	Per. ox: does not alter	On ch. not fused, soda absorbed; white or greyish white oxide remains on the ch.
7 Chromium *oxide.*	No change	No change	On p. w. and ox. f dark orange glass: opaque and yellow on cooling. R. f opaque, glass green on cooling On ch. absorbed but not reduced
8 Cobalt *oxide*....	No change	No change	On p. w. pale red by transmitted light, grey, cold.
9 Columbium *oxide*	No change	No change	Combines with effervescence but not fused, nor reduced.
10 Copper *oxide*....		Ox. f. black globule; flows over the charcoal; under surface reduces. R. f reduces with strong heat gives a bead of metal	On p. w. fine green glass, hot: on cooling colourless and opaque. On ch. absorbed and reduced
11 Glucina.........	No change	No change	No action
12 Iron, *oxide*.	Ox: f: no change	R. f. blackens and becomes magnetic	On ch. absorbed and reduced: not fused.

Ch: Charcoal. Ox : f: oxidating flame. R : f: reducing flame.

WITH BORAX.	WITH PHOSPHORIC SALT.	REMARKS.
1 Fuses slowly : clear glass	Clear glass	Fine blue glass with nitrate cobalt when cold, strong heat.
2 On ch : dissolves freely glass yellowish, hot; nearly colourless, cold: strong R. f; glass becomes opaque and greyish	P : w: and ox: f: glass yellowish, hot: colour flies on cooling.	
3 The hydrate and carbonate fuse readily with effervescence into a clear glass which becomes opaque when flamed	As with borax but they foam and intumesce ending in a clear glass	A globule of different shades of red which flies on cooling with nitrate of cobalt
4 (Oxide) ox : fl: colourless glass, R: f: partly reduced: muddy greyish glass	(Oxide), ox : f: yellowish brown glass, hot: colourless but not quite clear, cold. R : f: clear and colourless glass, hot: opaque and greyish black, cold	
5 On p: w: yellowish glass, colour flies on cooling. On ch. glass bubbles cadmium reduced, sublimes, and leaves yellow oxide.	Dissolves in large quantity, clear glass: on cooling milk white	
6 Ox. f. fine red, or deep orange yellow glass: colour flies on cooling: cold, yellowish tint, enamel white by flaming. In r. f. loses its colour	Ox. f. fine red glass, colourless when cold, and quite limpid	
7 On ch. fuses difficultly, glass emerald green. On p. w. and ox. f. the colour flies, and glass becomes yellow brown. When cold a faint green tinge	Green glass	
8 Fuses readily, deep blue glass	Fuses readily, deep blue glass. Colour violet by candle light	With sub. carb. of potash black glass when cold
9 Colourless clear glass becomes opaque by flaming.	Fuses easily, glass permanently clear	
10 Ox. f. fine green glass which in r. f. becomes colourless, hot: but cinnabar red and opaque when solid	Ox. f. like as with borax r. f. glass usually red, opaque and like an enamel	
11 Clear glass with a large proportion of the assay.	Same as borax	Black or dark grey mass with nitrate cobalt
12 Ox. f. dull red glass becomes clear and yellowish or colourless by cooling. On ch and r. f. bluish green glass	Same as borax	

Substance.	On Platina	On Charcoal.	With Soda.
13 Lead, *oxide*.	Minium becomes black when hot; at incipient redness changes to yellow oxide, fusible into orange coloured glass	Orange glass reduces into a bead of lead	On P: w: clear glass becomes yellowish & opaque on cooling. On ch. instantly reduced
14 Lime	No change.	....	....
* Do. carbonate.	Becomes caustic & alkaline, emits bright light.	....	....
15 Magnesia	No change.	No change	No action.
16 Molybdenum	Fumes and fuses; brown yellow on cooling; in R: f: blue; intense heat, brown.	Fuses and is absorbed and partly reduced	On P: w: effervesces; clear glass: becomes milky on cooling. On ch. fuses and reduced.
17 Nickel, *oxide*.	No change.	No change	On ch. absorbed and reduced, not fused.
18 Tellurium, *oxide*.	Fuses and fumes.	Fuses: effervesces: reduces	On P: w: colourless glass, white on cooling. On ch: reduced.
19 Tin, *oxide*	Takes fire and burns like tinder into peroxide.	R: f: peroxide does not fuse, but reduces in a strong prolonged heat	On P: w: effervesces: tumefied infusible mass. On ch. readily reduced
20 Titanium, *oxide*.	No change.	No change	Fuses into a clear dark yellow glass; white or grey white on cooling, and crystallizes with evolution of great heat. On ch: not reducible
21 Tungsten	R: f: blackens: not reduced	R: f: blackens: but not reducen	On p: w: dark yellow glass; crystallizes on cooling; opaque white or yellowish. On ch. r. f. reduced
22 Uranium, *oxide*.	....	Peroxide, becomes oxide, blackens but does not fuse	On ch: brown yellow: not fused
23 Yttria	No change	No change	No action
24 Zinc, *oxide*.	Yellow, hot: white, cold: does not fuse, give out great light at a high heat & white fumes which condense like wool	———————	On ch: not fused: reduced with flame: white fumes which cover the charcoal
25 Zirconia	Infusible: emits intense light	Infusible: emits intense light	No action

Gold ....Platina........ }
Iridium........Rhodium. .... } These metals have no action on the fluxes.
Palladium .... }

With Borax.	With Phosphoric Salt.	Remarks
13 On p: w: clean glass, yellow hot; on cooling colour less.	Clear colourless glass	
14 Clear glass opaque by fl:	Fuses in large quantity; a clear glass	With nitrate cobalt an infusible black or grey mass.
* Fuses with effervescence, with more carbonate, clear glass: crystallizes on cooling.	Fuses with effervescence	Ditto.
15 Clear glass opaque by fl:	Fuses readily; clear glass: opaque on cooling if saturated with magnesia	Flesh colour when quite cold with nitrate cobalt
16 On p: w: clear glass in ox: f: on ch: and r: f: glass becomes dirty brown, but not opaque.	On p: w: and ox: f: greenish glass while hot: colourless cold. In r: f: becomes opaque: dull blue, hot: clear fine green on cooling: and on ch: same phenomena.	
17 Ox: f: orange yellow, or reddish glass: becomes yellow or nearly colourless on cooling.	Same as with borax, but the colour flies almost wholly on cooling	
18 On p: w: clear colourless glass, white on cooling on ch: grey and opaque	....	Metallic tellurium heated in a glass mattrass first gives off vapour, and then a grey metallic sublimat of tellurium. In a tube open at both ends, it emits abundant fumes, which condense in a whit e fusible powder
19 Fuses with great difficulty; permanently clear glass.	Same as borax.	
20 On p: w: fuses easily; glass colourless, becomes milky white by flaming. R. f. glass assumes a dark amethyst colour, but transparent. In large quantity on ch: and r: f; glass dull yellow; when cold, deep blue	Ox: f: clear; colourless glass. R: f: on ch. glass yellowish, hot: on cooling, first red, then very fine blueish violet	Black or greyish black with nitrate cobalt.
21 On p: w: and ox: f: clear glass: not opaque by flaming	Ox: f: yellowish glass: r: f: fine blue glass. If it contains iron, blood red glass. Tin makes it green or blue	
22 On p: w: dark yellow glass in r: f: becomes dirty green	On p: w: and ox: f: clear yellow glass: cold, straw color, slightly green. On ch: r: f: fine green glass	
23 Clear glass with a large proportion of the assay: opaque by flaming	Same as with borax	With Nitrate cobalt black or dark grey mass
24 Ox: fl: fuses easily; clear glass, becomes milky by flaming	Nearly the same as borax	
25 Clear glass with a large proportion of the assay: opaque by flaming	Same as with borax	

IV.—*Essay on the Language and Literature of the Telugus.—By* Charles P. Brown, Esq. *of the Madras Civil Service.*

(Continued from our last.)

63. The Telugu Poems may be divided into two classes; popular and classical. The *popular* works (sāmānya cāvayamulu) are principally written in (dwipada) uniform couplets: and are much in the familiar style of Ovid, Gay's Fables or Scott's Marmion. The *classical* (măhā cāvyam) are usually in (padyamulu) stanzas: and may be compared to the Odes of Horace, or Gray. On the principles adopted in western criticism the taste displayed in the former class is often worthy of approbation. Even in these, bombast, immorality, bad taste and childish conceits, frequently occur. But these rhetorical flourishes are far more prominent in those poems which are written in stanzas; doubtless each of these admired works contains a *kernel* of really pleasing poetry, but this is preceded by many a page of ill judged rhetoric, wherein the poet is evidently a mere grammarian, " a word catcher (as Pope says) who lives in syllables." He rejoices in synonymes, and the dictionary is never out of his thoughts. In many stanzas (particularly in the metre called sisa) the same thought is thrice reiterated with a mere change of phrase. Thus "*the fair maid decked with these jewels entered the presence of the king. The bright damsel arrayed with these gems passed into the court of the prince. Such were the adornments of the beauteous nymph when approaching the royal threshold.*" Such passages possess an undeniable value as regards the foreigner, who will find these stanzas a most convenient substitute for the Amara Cosha and similar vocabularies of synonymes. But the taste they display is paltry enough.

The absence of these and other pedantries renders the poems written in couplets much more agreeable to a foreigner: who will value them for that simplicity which is a fault in the estimation of learned bramins. Besides, most, perhaps all, the Dwipada poems are the composition of sudras; whereas the Padya poems are in general the work of the sacred tribe: yet the great boast of the nation, the one Bhat't'u Mu'rti, or " inspired bard," who wrote the Vasu Charitra was himself a Sūdra.

With a few exceptions all the poems are founded on a popular story borrowed from the Purānas: which the poet alters at his own pleasure till it deviates as widely from the original as Byron's Don Juan, or Milton's Agonistes deviate from the original ground work.

64. Most of the popular fables have been framed in verse both in couplets and in stanzas. But no poet that I recollect has written in

both styles; unless in the *sangitas* which will presently be mentioned. The dwipada version usually appears to be the oldest, for the style is comparatively simple, and we may often detect expressions, borrowed thence, in the Padya version. The two versions of the Rāmāyan appear to be independant of one another; but in other works (as the Basava Purān, or the Prabhu Linga Līla), the padya version evidently is a superstructure, and introduces conceits and extravagancies which deviate from the original more widely than Dryden's and Pope's imitations of Chaucer vary from the original. On the other hand there is no dwipada version of the Mahabhārat, though the tale of Nala and several other legends imitated from it are composed in couplets.

One class of the poems written in padyams consists of the *Satacams* or anthologies; which are similar to the *centuries*, or *garlands* which some old fashioned English poets composed: being a series of songs, or separate epigrams, bearing a general resemblance in subject, metre, and chorus.* Some of these are of acknowledged poetical merit, as the Bhascara satacam, the Ecāmra Linga S., the Cālahasti S., the Dāsarathi S.—others are of a lower class such as the Sumati S., the Caluvai S., the Códanda Rama S., the Cāntā Lalāma S. and others again, as the Vemana Satacam, the Siddha Rāma S., the Sampagamanna S. are acknowleged to be in the mere colloquial dialect, and are composed with no scrupulous regard to the rigorous laws of rhyme and elision. Though deficient in elegance of phrase these rustic songs are not devoid of poetical merit, and are attractive to a foreigner on the ground of exhibiting a familiar style, and a great variety of useful expressions. —These *centuries* are again divided as appertaining to (nīti, yōga, and sringāram) morals, mysticism, and love.

65. In one description of poems alone the "couplets" are mingled with "stanzas." This class is called (Sangītamul) "musical compositions" such as the Sītā Calyanam, the Lanca Vijayam, the Garadāchalam, &c. wherein the variety of tunes, or modulations (padamulu) introduced is entirely different from the classes hitherto noticed. Under this head are comprised the various comedies (natacamulu and bhāgavatamulu) which are performed by the public (bogamvandlu) dancers and actresses. Finally there are other ballads (cathalu) of great length framed in a peculiar chant, on principles different from all other sorts of poetry. Some of these as the Bobbili Catha (or Ranga Rao Charitra), the Nāgamma Catha, and the like, are chiefly preserved by oral recitation without having been until now committed to writing. These

* Many of these Satacams have been printed at Madras: a second edition of Vemana, much extended, has lately been finished; to which an English translation, separately printed, is subjoined.

are every where popular: though despised, as illiterate, by professed scholars. The name *Yaxa-gānam*, or "melodies" is appropriated to the *Sangītamulu* first mentioned: and discriminates them from the *Cathas;* which run in one uniform metre with a chorus constantly reiterated.

66. A superstitious monotony, far from pleasing, and imitated from the Purānas occurs in the commencement of every (padya-cāvyam) poem. The Jangama books alone deviate from this routine, and are for this particular reason much disliked by bramins.* The preface first extols Vishnu or Siva under some attributes that designate the poet's creed. Then the author extols the patron and himself in no measured terms, specifying the respective genealogies. Yet he rarely mentions the date when the poem was composed. Then follows a request made by his patron that he will undertake this tale. Thus far is called the Avatārica or preface. He now commences by describing the Naimisha forest (the Academus of India) with the hermits (muni), or philosophers who there vegetate. These commence an enquiry regarding the hero; and resort to some mighty teacher (yogi) usually Suca (the parrot), or Nārada (Mercury) who consents to gratify their curiosity. He begins with the birth of the hero, and this terminates the first (āsvāsam) canto which is denominated the Cath'ārambham or introduction. The story commences from the second book. And each canto opens and closes (āsvāsa garbham) with high flown panegyrics on the munificent patron.

67. The following list comprizes all the most popular poems with the names of the authors. The more celebrated compositions are marked in capital letters. The (T) is used to dencte that the text has in the last few years been completed and corrected by the aid of various manuscripts. In this operation fifteen copies were compared for the Dwipada Rāmāyan, twelve for the Mahabhārat, eleven for the Bhāgavat, and smaller numbers for poems less corrupted by time.

Such as are marked (c) have, besides a corrected text, a commentary written in familiar Telugu which explains every word The learned men whom I employed to frame these commentaries were required to give a literal rendering: but the art of criticism is yet in its infancy among the Hindus, and much remains to be effected, both in abridging and amplifying these scholia.

68. The first poet to be mentioned is Bhattumurti, in whom his countrymen delight as greatly as the English admire Milton. His most celebrated poem is the Vasu charitra: which is now issuing from the press with an ample commentary. The poet's name was Rāma Rāzu:

* The Jangamas refuse even to write *Sri Rama* at the commencement of books and letters. Indeed they discountenance every one of the braminical superstitions.

the name Bhattu Mūrti, or *Mirror of Minstrelsy* being an epithet, which has now become his sole appellation. He had originally designated the Vasu Charitra after his own name as the Rāma Rāzu Bhūshanam. Two other works of his, the Narasa Bhūpāliyam and the HARISCHANDRA NAL'OP'AKHY'ANAM are also highly celebrated. In the latter he has imitated the Naishadham by framing an entire poem with two meanings. For in one interpretation of the words, they apply to the monarch Harischandra; in the other to the spouse of Damayanti.

The Narasa Bhupaliyam is thus named after the *nominal* author Narasa Rayalu, the poet's royal patron, who died in A. D. 1430. In like manner Calidasa is stated to be the author of the *Magha:* but the writer, whoever he was, has distinctly attributed it to his patron "the merchant Magha." This mode of adulation is followed by Hindus at the present day, for they often propose to publish in the name of an Englishman books written by themselves. It must however be allowed that no deception is seriously intended, and the *adoptive* author never really gets credit for the work.

69. The style exhibited in Bhattu Murti and his followers will never meet with much applause among European critics. The rapture it excites among his countrymen will be rightly valued when we recollect the state of Hindu taste. The ingenious Thomas Hood has in many of his Facetiæ manifested a power of punning which would have gained him a very exalted seat on the Indian Parnassus. For the most admired poets revel in learned quirks, the (slesha) double and triple meanings of words both Sanscrit and Telugu; in (chhēkam) jingle of sound: in a rhapsodical sublimity (utprēxa) which answers pretty closely to what the French poets call *charades:* performing innumerable feats of perverted ingenuity which as Dr. Johnson says "are so difficult that we are inclined to wish they had been impossible." To learn the most admired verses of these poems by memory is a task imposed on many a Hindu schoolboy, but to teach him the meaning is never even attempted. It will not be easy to persuade the Hindus that a mere exercise of memory is not meritorious. The English reader cannot expect to derive much gratification from a poem which is avowed to be so obscure that even the most learned pandit is in many places obliged to confess his inability to understand many pages unless by the aid of previous study.

Some assert that this poet likewise wrote the Pānchāli Parinayam or Nuptials of Draupadi, but I have not met with any poem bearing that name. It only remains to remark that the title Bhattu Mūrti was bestowed upon him by his royal patron Krishna Rāyalu, who was the son of a handmaid of Narasa Rayalu and succeeded to his throne.

70. In noticing the faults of style in the Telugu *higher* poets it is but just to notice that they are free from that sort of bad wit which is

called (bandha cavitvam), or verses written in whimsical figures. Among the dwipada poems this conceit is unknown: but few of the *modern padya* poems are free from it. The learned commentator on the Dasāvatāra Charitra has in such passages left the verses unexplained, and states that he did not pretend to unravel intricacies which all the greater poets had despised. I mention this conceit only with a view to warn the reader that such verses are unworthy of study. For he is often advised by bramins to turn his attention to a variety of intricate refinements which further experience will prove to be worthless.

71. Allasāni Peddana, author of the Manu Charitra, or Swārōchisha Manu Charitra (c), who also wrote the Vishnu Chittiyam or Amucta Mālyada (on which we have a good commentary about a century old), and the Rasa Manjiri, which last is not now known to be extant. The Telugu version now read of the Rasamanjari purports to be written by one Ananta. Perhaps this is a name assumed by the author. Peddanna was a Bramin, and received from his royal patron Krishna Rayalu the title of Andhra Cavita Pitāmaha, or sire of Telugu Poesy—which, tradition says, was denied to Bhattu Mūrti on the ground of his being a Sūdra.

In the preface to the Vishnu Chittiyam the poet mentions other works which he had composed. These have not come to light, nor do I even find them quoted in Appa Cavi.

72. Muccu Timmana (the Ovid of the language), author of the Párujāt A'paharan'am (t) and the Vāni Vilāsam. This is a modern author who wrote less than a century ago. He wrote the Rasica Jana Manobhirama, and many other poems.

73. Tennala Ráma Lingam, author of the Pandu Ranga Vijayam. The style of this poet is remarkably intricate; as is noticed in the following popular epigram on the four poets now named :—

" *Allasāni Peddan allica jigibigi*
Muccu Timman Arya muddu palcu
Pāndu Ranga vibhuni pada gumbhanambu nu
Cāca māna Rāya nīkĕ tagura."

" The rhetorical powers of Peddana, the sweet notes of Timmana, the abstruse eloquence of Ráma Linga, all unite in thy lays, O (Bhattu mūrti) bard of Cācamána !"

The secondary meaning which some pretend to find in this epigram is not worth notice.*

* Style is fancifully classed as that of the *grape, plantain,* and *cocoa-nut.* Of these the first, *dráxa pácam* is exemplified in the Telugu Ramayan ; being quite easy. The second, *cadalí pacam,* wherein *part* of the fruit alone is eatable, is assigned to a more refined dialect: and the third, *nárikéla pácam* designates the degree of rhetorical obscureness which we find in the third poet here named. These phrases are frequently used in the conversation of learned men, and I notice them here because they are unmentioned in any work hitherto printed.

This Ráma Lingam is usually mentioned as a humourist and a profligate. I have not met with any complete copy of his poem, and I observe that the volume now extant is often attributed to another writer.

74. Srī Nátha, translator of the NAISHADHAM, the KASI KHANDAM (T) and Bhīma Khandam from the Scánda Purán. It is also said that he wrote the Marudraja Charitra, the Hara Vilásam, and the Sálivâhana Sapta Sati. But I have not met with these books.

Srinatha is also said to have written a series of songs called the Vīdhi Natacam of which only about thirty have been preserved by oral tradition. Some of these have considerable beauty: but others, written perhaps by his imitators are far inferior.

75. *Pingala* SU'RAPA RAZ, author of the R'AGHAVA P'ANDAVYAM (C), the Cala Pūrnodayam, the Prabhávati Pradyumnam, and the Linga Puránam. This last is not now extant.

76. *Chēmacūra* VENGAL RAZ, author of the Sáranga Dhara Charitra in Padya metre (T) and the Subhadra Parinayam also called *Vijaya Vilāsam* (C).

Canuparti Abbaya, author of the Aniruddha Charitra (C) also called Usha Parinayam, and the Purūravas Charitra (T): which is also called Cavi Raja Mano Ranjanam.

Erra Pregada—who translated part of the (Aranya Parvam) third book of the Mahabharat (T): he likewise wrote the Hari Vamsam in Telugu.

Potu Razu, the translator of the Bhagavat, (T) which has already been described. The poet had two auxiliaries; Gangaya who executed the fifth book; while the sixth was written by Singanna. Poturaz likewise wrote the Narayana Satacam; and having honoured Vishnu as the deity, in the Bhagavat, he wrote likewise the Vīra Bhadra Vijayam in honour of Siva.

77. *Dharanī Dēvula Nagaia,* author of the Das Avatara Charitra (C), a very popular poem; being a highly coloured description in ten books of the adventures of Vishnu, or Krishna.

We may here observe that the great popularity of the Bhāgavat or Life of Krishna arises from its combining all the reveries of mysticism with broad licentiousness. The poetry of the Telugu version by Pōtu Rāz and his coadjutors being disapproved* as tame, some modern Telugu

* It is hard to reconcile the extraordinary popularity of the Telugu version of the Bhagavat, with its condemnation by strict grammarians. They frequently tell us that Appa Cavi entirely disapproved it, as is shewn by his never naming it. But he names many other volumes with condemnation, and a more reasonable cause may be, that it was written after his days. The style is very florid and undeniably beautiful, though much amplified: for instance, in describing Krishna's sports with the nymphs there are many hundred lines which the poet has added to his Sanscrit original.

poets have undertaken to model the amorous descriptions anew—neglecting the theological discussions. Hence arose the Dasāvatāra Charitra or novel of the ten appearances; and the yaxa-gānam Bhāgavatam —that is, the tale of Krishna arranged in musical melodies. In these books (as in the Rādha Mādhava Samvādam and the Dévi Bhágavat) the principal heroine is Rádha, a nymph wholly unmentioned in the original Bhágavat, and who owes her origin to the poetical imagination of Jaya Déva, the Theocritus of India, author of the charming Gíta Góvinda.

The well known poem called Ahalya Sancrandana Vilasam, or the intrigues of Indra (Jupiter and Alcmena) is the seventh book of the Dasavatara Charitra. There is also a separate poem bearing the same name in five books: but this is a mere cento of verses borrowed from various poets. The author's name is Mulugu Papaya.

It may be worth while to remark that though the Telugus possess no stated version of the four most celebrated Sanscrit poems, (the Mágha, the Cumára Sambhavam, the Mégha Dúta and the Gíta Góvinda), their bards have extracted and adapted all the most attractive scenes. I am aware that the Raghu Vamsam has been translated, as also the Sacuntala—but these are the work of ordinary Telugu composers, vastly inferior to the celebrated originals.

78. Narasimha, author of the Cavi Carna Ras'ayanam, or adventures of Mándháta (c), a poem which has received very high applause.

Sēsham Vencatapati, author of the Tara Sasanca Vijayam (c), or "Stella and the Genius, a Romance." This is an exceedingly popular work.

Vencata Nátha (a Cshatriya), author of the Telugu translation of the Pancha Tantram (c). This was originally a "moral" work; but as treated by the Telugu author it properly belongs to the romantic class.

To these may be added a long list of popular novels and "histories" (Charitra) such as the Surábhand Eswaram (c), the Rádha Mádhava Samvádam (c) and the Ila Deviyam (c), also called Rádhica Santwanam: this is written by a poetess who has very elegantly remodelled the Rádha Madhava Samvadam into a new form: wherein she has polished and perfected the style wherever it was rustic. The Cuchel-ōpakhyan (T) in three cantos is likewise a very popular work.

79. But whatever popularity has been attained by these poets philologists with one voice declare Ticcanna to be the unrivalled model of style in the Telugu language. His first work seems to have been the seventh book, or supplement (uttara canda) of the Ramayan which bears the name of Bhascara. Ayyala Bhatta and Mallic Arjana were Bhascara's coadjutors: the former completed the sixth book and the latter wrote the fourth and fifth. After the seventh was completed by

Ticcanna, he gained the epithet Sōmayagi or Auspex for he bears this name in the Mahabharat. Yet regarding so popular an author we have no biographical accounts, and it is only surmised that he lived before the era of Krishna Rayel.

I have mentioned the remote age usually assigned to Nannaia Bhatta but perhaps we may safely place him in the century preceding that which we have conjecturally assigned to Ticcanna.

Second to Ticcanna, in critical estimation, stands Allasani Peddanna who has already been spoken of: and next to him, as regards beauty of style, stands Ayyal Raz RamaBhadraya, author of the Ramabhyudaya.

80. All the poets now named appear to have written before A. D. 1700—excepting Muccu Timmanna and the author of the Das avatára charitra; the last century produced but few other poems of any note: one is the Balaráma Vijayam (also called by the pedantic name Prabandha Rája Sirō Bhūshanam), and another is the Bahulásya charitra. These are little more than imitations of the Tára Catha, Das Avatára charitra and other well known tales: but the modern poets conscious of their inferiority to the older bards attempt to outstrip them in grossness of immorality. The Satyabhama Santwanam, a very favourite modern work is conspicuous for its bad taste in this respect. These poets certainly do not go to that unutterable excess of filthy whimsies which we too often meet in the Mahabharat, but their superior elegance and brilliant adornment perhaps only render them the more pernicious.

The Jangama or Saivite literature is as remarkable for innocence as that of the Bramins is for vice. But the Saiva poems will furnish ample subject for another essay. The Lila and the Tale of Sarangadhara, from which selections will now be offered, belong to this class.

81. Among modern poems high applause is given to the Bhanumati Parinayam,* which is a pretty close imitation of the Vasu Charitra. The Telugu versions, likewise, of the Bilhanam, and the Krishna Carnamritalu are, as well as the Cama Cala Nidhi, very popular poems of the 18th century. Among modern writers the highest place however is conceded to Muccu Timmanna, who (particularly in his Nila Parinayam) has used a vast variety of obsolete phrases which excite an irrational admiration. The same taste is displayed in the Satyabhama Santwanam.

82. This dialect is called Açça Telugu (or pure Telugu), a name justly due to many thousand lines throughout the Puranas and poems.

* Distinct from the Bhanumad Vijayam, a Saivite poem which will be elsewhere noticed.

As here applied however, it denotes an Euphuistical dialect (to borrow a phrase from Scott's "*Monastery*") which certainly never was spoken, and goes upon the principle of excluding, if possible, every Sanscrit word. Many of the phrases used in Aççа Telugu are supposed to be Canarese words: but the same opinion is held regarding many of the obsolete expressions we meet in the Telugu Mahabharat. The truth perhaps is that these words were originally used in one language and in the lapse of time transferred to the other. In like manner Chaucer, Spenser, and Shakspeare use several words which at the present day are not English but Scotch, or German.

83. The Hamsa Vimsati (T) calls for notice as exhibiting a variety of singular Telugu expressions. This poem is the work of Ayal Raz Narayanappa whose father translated the Ramabhyudaya. It is in five books containing twenty tales; which for morality are parallel to Boccacio or the Tales of a Parrot. But the aim of the work is to embody the various words used in every dialect of Telugu, one tale is regarding a weaver, the next describes a potter, the third a forester, and so forth; and the poet has ingeniously introduced every expression which each particular line of life may illustrate. In fact it is on the plan pursued by Corderius in his Latin Dialogues, or by Buonaroti in his Italian comedies.

84. The Suca Saptati (T), or tales of a Parrot (a separate poem, in three books) seems intended as a supplement to the Hamsa Vimsati or tales related by a Phœnix. In a poetical point of view the Suca Saptati is superior to its predecessor; and, for the sake of variety in amusement, it introduces much of the rough primitive dialects and strange pronunciations found in various parts of the Telugu country. Many of the minor poets have recorded such varieties of dialect but no where do we find them so fully displayed as in the two works now mentioned.

85. We will now proceed to adduce specimens of the most popular POEMS. A few lines of the original will be given in the English character for the satisfaction of those who may wish to compare the poetical language with that of every days conversation. But the entire extracts being too prolix for admission in this journal will be printed separately in the original character.

The first selection is from the Dwipada Rámáyan (T) which though remarkably easy in style ranks as a (cávyam) standard classic. So clear and flowing is the verse that several good judges consider it even more easy than Vemana or the Prabhu Linga Líla, which however are far more attractive to the English reader.

I did not at first recommend it to the reader because portions of it are rather above the reach of a beginner: but it has one strong recommendation. For it faithfully reflects the Hindu mind and acquaints us with all its qualities whether amiable or objectionable.* In this respect every page of the Dwipada Rámáyan is worth perusal: and, whether in this or other compositions, the reader should make himself thoroughly acquainted with the Dwipada style of poetry before he proceeds to the *padya cāvyam.* He may find this counsel beneficial though his native assistants may recommend another course.

The following extract from the Aranya Cánda or 3d book of this version of the Rámáyan gives the tale of Sīta, the heroine, being stolen from her lord by the giant Rávanásura. To delude the hero, Rama, Márīchi (a giant) assumes the appearance of a golden deer. The poet describes its radiance, and then proceeds as follows:—

86. "The fairy hind was of extraordinary beauty: as it rambled about, "chewing the cud, with a tail as freakish as that of the peacock; the "whiteness of the belly gleamed through the bowers; again its reddish "sides glistered like amber; when vaulting it looked like the rainbow— "or, as it sprung up it flashed like lightning. The forest herds of deer "were startled at its singular appearance: for it lay as in ambush and "its form was suddenly seen now here now there: one while it drew "near, and then as though startled it bounded aloft, rushing through "the thickets—then with a leap it took refuge in a bower. One while "it put its nose to the ground wagging its tail and pricking its ears at "distant sounds. Then it pricked one quivering ear and flew like the "wind: then it reposed on a grassy spot: then rising it drew near the "hermitage, it scratched its ear with one foot and shook the high flow- "ering boughs with its horns so as to pour the blossoms on the soil."

While it thus strayed among the bowers of the recluses, the blooming Síta with tinkling anklets came out of the arbour to collect the opening

* The Ramayan written in couplets is more faithful than other versions in its adherence to the Sanscrit text. I may mention one remarkable instance. In the 129th chapter of the sixth book (Yuddha Canda) is a long description of worship offered by Rama and his companions to the lingam, or symbol of Siva, to atone for the sin of slaying Ravanasa: who is declared to be a sinful wretch and meriting death, but his being a bramin renders it a mortal sin to slay him. This legend inculcates the adoration of Siva; and likewise shews that the sin of braminicide may be removed. This passage occurs in Ranga Natha's version, and also in the Telugu Adhyatma Ramayan; though not in every manuscript: and the entire legend is omitted in Bhascara's and in two other versions, and is even wanting in the Sanscrit copies which we possess in Southern India. Now the Ramayan is more highly honoured than any other poem; it is considered as absolute scripture; and yet sectarian bigotry has led Bramins thus to mutilate a document which they profess to hold in the highest veneration.

flowers: at the sight of this fairy fawn she was filled with surprize; she called to the lord of men, her spouse, and thus addressed him.

Never till this day did I see so charming a creature as this—how I long to recline, O prince, on a couch formed of its skin. O thou leader of the solar race, pursue this creature, strike it, and bring me its hide—yet why? I wish thou couldst catch it without frightning it, which would be far better :—O my spouse—we should keep it at our leafy dwelling, and when our appointed term finishes let us take this golden fawn home to the city and shew it to the king and to my aunts' and cousins:—how they will be delighted at such a present! (70—95).

Thus spoke Síta in affectionate tones; Laxmana listened to her and thus addressed Ráma: was there ever, brother, seen so bright hued a fawn? Can it be that a brute creature has such wondrous colours? It must be a mere delusion, unfit to be credited! surely it must be a vision raised by (asura) demons—besides, possibly it is the hermit Máríchi who lives here, for he is a cruel demon and continually roams the forest in a superhuman form. Have not we heard so—possibly it is that fiend—perchance he has come here to tempt us into ruin. Do not then set your gentle heart on this and be disquieted, or entertain the thought of catching the fawn. Besides—though the lady of Videha (i. e. Sita) should be so simple, be not thou so foolish O prince of men!

At these words Ráma looked on the bright countenance of Síta; he smiled, and thus addressed Lacshman (96—110).

Why be agitated at this, O son of Sumitra. Though even it were a giant-raised vision certainly will I bring the deer home, and I will slay the mightiest giants that can come; believe these two points—one or the other will I do: for I will chase it, I will slay it, and give the hide to Janaca's daughter. After so long a time she has made only this one request. Can I neglect Sīta? can I decline the deed she points out? stay thou with her affectionately, neglect not the lady of the bower.

He said and committed all to Laxmana; and gently taking his bow from his brother's hand, he bent it, and duly set out, like Siva when he set out in pursuit of the *Lion giant* who carried off the sacrifice.

* * * * * * * *

" He went on slinking behind the bush stooping as he walked, bending and running alongside; whenever it looked back he stood concealed, he was on the point of catching it, it escaped, and he was vexed. He held the bow and arrows ready to shoot, he laid his footsteps softly on the soil so as to make no sound, as he observed its traces, he eyed its path, and goings (neppu, an obsolete word), and concealed himself. Here it is—I'll catch it—Here it comes—see—Its mine, cried he merrily."

" Thus thought he, but the deer caught a glimpse of him from afar—it let him draw near; but as he stretched to seize it, it bounded from him and fled. Alas cried he in anger, as it stood to gaze at Ráma. Then it fled to the horizon while the foam flowed from the corners of its mouth—it seemed out of heart; then looking at the huntsman it sprung up elastic and fled at speed, while the skies seemed to flash with its brightness; then it vaulted* away; its tongue flashing like lightning bright as a waving torch; for it moved as rapid as a potter's wheel circling at speed. Then it paused as though faint, it seemed to drop close to him—then like a goshawk it flew up to heaven. Ráma was now wearied as well as astonished: he paused, he looked around—but now the creature to cajole him stood still—but as he formed the idea of shooting it, again it vanished: then as he gave up the hope and turned homewards, behold it was again at his side, like a vision; and carried the son of Cácustha who was now wearying, further and further, for deluding his glance, it fled into inaccessible hills (112—150).

Seeing this Ráma perceived that this was a fairy hind—he exclaimed Where, O my foe, wilt thou hide from me? * * * * * * * *

So saying he levelled the celestial arrow at the prey—which instantly rolled over and now laying aside the fairy form, uttering a delusive shriek, cried " O Lacshmana! O Sīta!" (155–165).

Then stretching his prodigious giant corpse on the soil, the wretch gave up his life—it seemed as though all the giants and their prince Rávana fell: as though their capital, Lanca, perished.

When this fairy deer fell on the earth, the lord of Sīta was well pleased: for he clearly saw it was indeed Márīchi: he remembered with approbation the words of his brother. How deeply, thought he, will he and the bright eyed daughter of Janaca grieve at hearing their names uttered in the dying shriek of this deluder: for he imitated my voice exactly: I marvel where they are and what has become of them.

So saying he mournfully pondered. But the dreadful cry reached the ears of Sīta, and struck her with horror to the earth: then when she recovered her senses, she gazed wildly around and was utterly downcast.

Then in her agitation she raised the weeping cry, and gazing on Laxmana, she exclaimed. Alas! son of Sumitra, what may this be that has befallen us this day: surely Ráma cries on thee with weeping voice. O hero, listen to that voice! wilt not thou give ear to it? or does it not reach thy ear? thou shrinkest not—thou shewest no ter-

* (I use various English words to convey the various Telugu synonymes employed, The phrase here is *cuppinchi*.)

ror, or horror, thou grievest not—what is this? while my heart heaves violently with horror and despair! Alas! he went alone into the forest. It is late—and he cometh not—surely he hath this day fallen into the hands of the giants. Delay not—go, I pray thee, to the prince! (166—200).

She spoke, pouring floods of tears and Laxmana replied thus to the child of Janaca.

Mother, why art thou alarmed? surely no evil shall ever befall thy spouse Ráma. Dost not thou know the valour of thy beloved lord? Is it right to give vent to words so agonizing? surely this is the scream of some demon who wishes to terrify thy heart. What hath such a pitiful shriek to do with the hero of the solar* race. O daughter of Janaca wherefore art thou thus agitated? I will without hesitation follow the prince Ráma: and shall the giants who oppose him maintain their footing? they are no more than crickets that exult against wildfire. They will in the end fall into it and turn to ashes or like the mighty serpents that raise themselves against the eagle and perish in his talons—or like a herd of elephants that rush upon the lion† (200—244).

No, I am afraid to leave thee—no—be not weary of me—plant these my words in thy heart. Be not grieved, O daughter of the king of men. At these words the fires of wrath arose in the heart of the lady and grieved, she thus addressed the son of Sumitra.

Thou! art thou faithful towards Ráma? why art thou this day so base? even though thou hearest Sri‡ Ráma calling on thee by name, thou art, like a foe, filled with hatred in thy heart—is this becoming?* * * * * *

Thus spoke Laxmana with his eyes filled with tears, and as his heart could bear no more he exclaimed Mother, I am gone, I will without delay bring thee thy lord, grieve not!

He said, and departed. But first he drew seven circles round the bower, and said Mother, pass not these limits, and should any one venture to cross these lines, the intruder shall instantly pay for it with his head.

Then he addressed the god of fire, saying. Be not careless. I commit the dame to thee!

* The two most ancient royal houses of India are traced up, one to the Sun, the other to the Moon.

† Which is supposed to feed on elephant's flesh alone. Here and elsewhere I omit the passages which are verbose or needless in a mere version.

‡ Sri is equivalent to saint; and St. George would be called Sri George. Here Sita proceeds to violent language, and as usual finishes by threatening to drown herself.

Then he respectfully bowed to the dame, and anxiously bent his way towards Ráma. The god of purity (fire) guarded Sita, and to delude her foes he formed a fairy image of her* which shone most glorious : so that all would have taken her for the real Sita 245—265.

At that moment Rávaná the giant arose with agitated heart. In one hand he bore a staff, in the other a scrip : in his forehead was an upright mark, and on his fingers he wore large rings of blessed grass with the sanctified thread across his broad breast : his right hand carried a large rosary : he was robed in clayed dust colour vest, with a necklace ... of the blessed tulasi tree, and he walked along stooping with the weight. His body was emaciated, he wore sandals, and a weather beaten umbrella; his hair was rolled up in a large bunch ;—in all points indeed he was a feigned friar (sanyási), and walked along counting over his beads and muttering his breviary. He dreaded lest the real monks (muni) should see and detect him ; his head tottered with hoar antiquity :—he sidled and stole along peeping to see where the fair one lay concealed. Then he would halt and exclaim Hari ! Hari† then a little recovering he drew near the skirts of the bower. At this sight the rural deities filled with alarm exclaimed,—Alas this sinful wretch is come to bear away the innocent Sita! he now stood at the door in the exact garb of a monk. The daughter of Videha instantly arose, supposing that this hypocrite was in truth a real hermit : she folded her lily hands [and incautiously crossed the magic circles drawn around her. These words are spurious]. The lady paid him all due reverence, which he shuddering received and as he viewed the damsel, he spoke thus.

Lady how is it that thou dwellest in this desolate retreat of the forests : how art thou left here alone? art thou Venus, or Psyche, or Juno or how can loveliness so divine be found among the dames of earth-roaming mortals ?

* * * * * * *

Who art thou, O fair one, why art thou wearing away life in this wilderness, O tell me. (266 319).

He spoke and Síta reverent replied, I am the spouse, O saintly one, of the stainless hero Ráma. My sire is Janaca, and Dasaratha is my uncle : my name is Síta. As the exalted Dasaratha hath banished us,

* The circles of fire and the delusive shape are mentioned neither in the Sanscrit original nor in the two Telugu versions named Bhàscara Ram, and Adhyatma Ram : the verses do not occur in all the manuscripts and are evidently spurious.

† Equivalent to Ave Maria.

Râma hath come to this wilderness, with me and Laxmana: we three have taken up our abode in this retreat as steadfast recluses. But a golden hind appeared to me, and looking at the prince I requested its hide—he is gone to seek it: after which I heard a dreadful cry of "O Laxmana," which pierced and dwelt in my ear. In my grief I reviled Laxmana and bade him begone: he is gone: and returneth not; I know not which way to turn.

She spoke, and looking at the hermit said Reverend Sir tell me your name and why you are come to this place.

The prince of Lanca scrupled not to lay aside for awhile his humble guise and thus replied (320-334).

Lady of the gentle eyes hear! I am the ruler of Lanca in the midst of rolling ocean. I am the chief of giants, the son of Visravas, and brother of Cuvéra (Plutus), lord of Yacas (Gnomes) and universally victorious: by name, Rávana [or Briareus] he who in battle faces and vanquishes both deities and giants. Lady! I heard of the riches of thy blooming face, and am come, full of eagerness to behold it. Why O dame shouldst thou thus pining dwell with a paltry fellow in the wilderness? all my realm, O bright eyed lady shall be at thy command with its wealth—for thy comfort and pomp there are bright chariots, and all other princely vehicles: and in the palaces thou shalt be waited upon by the wives and daughters of fairies and demigods, genies and giants. When the light of thy footsteps shines on my realm it shall blaze as with a wall of rubies. O Lady, the lilies of thine eyes shall shed their radiance like a triumphal wreath over my gates. Thy sweet smiles shall shine as the summer moon over the ocean of my happiness. Come come to my city of Lanca (335-362).

He said: at these words Síta was indeed filled with alarm, but like a spirited woman she looked upon him with scorn, and plucking up a blade of grass,* she turned her heart to Ráma and bending her eyes on the grass she thus spoke, without even looking at the enemy of gods.

Fellow! is it fit for thee to address me thus? surely ambrosia was created for deities and not for dogs! what face hast thou to dare to speak to me who appertain to the god-like Ráma? be decent and be gone to thy noble town. If thou wilt not go away by fair means, and if thou ponderest on any iniquity, know that my noble lord is matchless in archery: it was he who burst the bow of Siva and who smote the heads of the giants. He will reduce thee and thine to nothing! thou art to him no more than a fox is to a lion, or a fly to an elephant, or

* A common action, expressing, I do not care for these words.

a streamlet to the ocean, or a crow to an eagle! so vast is the difference between him and thee. Be wise then and retire to thy Lanca (363-384).

She spoke but the giant looked furiously at the daughter of Janaca, and throwing off his guise, in his insolence, as love stirred his heart he shook with eagerness and the gems that adorned his ten heads faded away: then had love more power than his twenty arms! he shone glorious in gemmed panoply, as the flames of love lighted up his visage. Dreadful was his form, and at the horrid sight as he advanced to her, poor Sīta fainted before him, she sunk down like a forest blossom before the rushing gale. The five faced giant beheld her drowned in tears, and with panting bosom and dishevelled tresses and broken garland while her whole form shuddered with anguish. He instantly seized the lady of the bright eyes, and placed her on his car; driven by fate to bear with him *her* who was, to him, the goddess of death, this foe of the gods sprung from earth, and hurried his steeds along the skyey road."

We will now insert the original text of a few lines in the English character, to shew how far the poetical dialect deviates from Sanscrit as well as from the colloquial Telugu.

Anina Rámudú Sitayanan ambujamu
Ganugoni, navvi, Laxmanu çúchi, palike;
Cheliimpan ētíki Saumitri, inta
Ila rāxasula māyal edurunē nannu
mrigam aina coni vattu mēt'i raccasula
tegan ēsi pori buttu delasi ī rent'i
tempu mai Laxman'a dīni ven dagili
çampi charmamu tech'i, Janaki—k' ittu
inni nāll'acu s'elavu ī cōrkĕ vēd'e
Chinna buttune—Sita cheppina sēta?
hitamativ ai pūni ī parnā s'āla-n
ativa ēmaracumīv' ani-y-appaginchi
yallana Raghu-Rāmud' anujuni chēta
vill andi mō pet'tí verav oppa vedáli
yága mrigambu munn arthi mē conina
yā gaj āsura vaíri anuj jennu mīri
çoncuçu poda marunguna ponchi ponchi
gruncuçu nantanta gūdá bāruçunu
magudí zūçutáyunu maruguna nílachi
taguluçu dappanga tamacam anduçunu
villun ammula vesa vērchi chē patti
yallana charanámbul avani pain iduçu
çappudú gāc' undá zādá gangonuça
çoppuna neppunu zūchĭ d'āguçunu
adĕ chērĕ battédan adĕ chēra vachén
adĕ lŏ badíyĕn ā cani chelanguçunu.

I vvídhambunam alaiinchi yā mrigamu
davvula podá zūpu dana jēra vaççu
patta bōina mitt'i pāra pōvu
catt' alca Rāmuni gann anta niluçu
lali desala ku bāru, lāla to' gūdá
selavul ambu'u rālçu chēshtálu maraçu
n esagi vīxinchi pell egasi lēll' 'urucu
pasa minçu minnula pai bāruç' undū
cuppinchi dātí chenguua tīgĕ merupu
drippina gati jihva dippun and anda
coravi drippina rīti cummara sārĕ
teraguna, bhramarìgā dìridìram dirugu
badalina gati mraggu pazza-k-ētēra
vadí sālvuvammu cai vadí mintá bāru
alasi Ramudu verag andi niluçutáyu
gelacula bodà zūpu kicurinchi tolagu
&c. &c. &c.

The reader will perceive from this extract that the style of the Dwipada Rámáyan, though poetical is clear, easy, and free from pedantry. The next extract is taken from a very popular poem, now about to be published at Madras. It is the tale of Sáranga Dhara written in the Dwipada metre: the other version written in *padyams* by Chémacūra Vengal Raz is remarkable for brilliancy and sweetness of style: but the Dwipada version is as usual in a conversational strain, and therefore more useful to a foreigner. The style in some places proves that this poem is ancient, but it is familiarly read at the present day. It exemplifies the rustic dialect of poetry which like the style of Burns shews more genius than classical exactitude. The author states that he composed it in couplets as an improvement upon the story as told by Chémacūra Appanna. To furnish a notion of the Hindu romances (not connected with pauranica legends), I will give a summary of this story. It is considered by Bramins as very immoral: it is precisely similar to Byron's tale of Parisina; but the braminical criterion of morality is oddly inconsistent; it condemns such narratives while it sees no harm in the foulness that fills the Máhábhárat and Bhágavat.

TALE OF SARANGA DHARA.

Introduction: genealogy of the hero: his birth. His father had a portrait of Sáranga Dhara taken, and sent it to other kings: one of whom offers his daughter Chitrángi to be wedded to him. Description of her charms. The prince's sword being sent to her she is wedded to it and brought home. But his father on seeing her was so greatly enamoured that he persuaded her that the painting represented not his son but himself. Hereupon he made her his second wife: the first who was still living being the mother of Saranga Dhara.

The king one day goes to the chase, the poet gives a lively description of hunting in all its details. Saranga Dhara happened to be at play with other boys, a favourite pigeon escaped from his hand, and entered the window of the tower, wherein Chitrāngi was seated, talking with her parrot. The whole description is minute and lively: she caught the pigeon, and desired that the boy might be sent up stairs to her. The minister's son in vain warned Saranga Dhara, against entering the seraglio; warning him of the peril of conversing with women. The prince rejected his advice, and entered the seraglio. Description of the palace, and the ornaments of the chambers. Interview with the princess. He fell at her feet but she at once gave way to her passions, and was violently enamoured of him. He replies to her flatteries by declining all her civilities a long dispute between them after which he makes his escape and retires.

Chitrāngi being now driven to desperation disfigured herself in a soiled dress as is usual in mourning. Description of evening: night fall and the rising of the moon. At dawn the king returns she accuses Saranga Dhara of having outraged her. The king's fury: he details the charge to his ministers: their horror: they counsel him to ascertain the truth from the boy. The message sent back by Saranga Dhara. The king commands that he shall be put to death: and delivers the royal seal as a warrant to the executioners, who were ordered to cut off his hands and feet, and leave him to perish in the forest. He is carried to the place of execution: the horror and grief that fill the city, where Saranga Dhara was a great favourite.

The king now retired from the court, and lay down on his couch in deep grief. Description of evening.

Saranga Dhara's mother hearing the dreadful tidings repaired in agony to Chitrāngi, and fell weeping at her feet.

The poet describes the king consulting whether he ought to slay his son Saranga Dhara at the instigation of his young wife.

The minister now advises the king to exercise patience: he tells the well known story of the weasel killed on suspicion of killing an infant which it had saved from a serpent; and to exemplify the necessity of caution he narrates the following fable.

Translation.

In old times there was a prince named Vaidarbha, who had no offspring, and was fond of a scarlet parrot whom he reared: indeed he passed most of his time in talking with it, regarding it as a son. He lavished all his affections on it, and it was so well instructed that it would salute by name any one whom it saw. After some time passed in this manner, there arrived a flock of other parrots from the western isles which filled the park; and at the king's permission his favourite parrot went to

converse with them: at last it accompanied them to their home in the isle of Salmali. Here she rejoiced in the variety of strange trees, and the nectareous mango above all. She was assured that those who ate of it should, though old, recover the bloom of youth she considered that her prince would be benefited by this fruit; which she therefore cropped in her beak to bring it home to the palace.

But there was a serpent lying near the tree who saw what she did and in wrath exclaimed. Surely I had come to obtain this fruit, and have waited here for a year in anxious expectation enduring every hardship, and now I can get neither good nor bad of it.* Is it fair for thee to carry it off? Give it me!

But the parrot rose up in the air, and so far from granting his request bent her way home to the palace, and laid the fruit before the king, relating affectionately all that had passed. The prince was delighted, and thus addressed his wife in the chamber. If I avail myself of this, I shall indeed regain a youthful form, but, lady, this will benefit myself alone. I therefore think it wiser to plant this as a seed, let it sprout, and become a great tree, loaded with continued fruit, and the fruits shall be distributed to the aged to restore them to juvenility. Thus shall I acquire the fame of a virtuous deed. His spouse assenting to this he planted the noble fruit, he duly watered it, it sprouted, and grew to be a tree.

But the serpent who erst remonstrated with the bird did not fail to pursue her, and took up his abode in a termite-hill at the foot of the tree, rejoicing to think he would now be revenged. After a while the mango tree bloomed, and shot forth its branches, flowering gaily, and bearing abundance of fruit- At last one mature fruit fell on the soil, and he satiated his malice by biting it so as to infuse mortal poison into it: he filled it with venom, and then returned with all speed to the isle of Salmali.

The watchers in the grove perceived that a fruit had fallen. They took it to the king who rejoiced over it, with his ministers, and said "surely this is the first fruit! let us therefore present it to a bramin, and then shall we securely enjoy the rest. He therefore sent for the (raja-purohita) royal confessor, and reverencing him, requested him to eat it. The bramin ate the envenomed fruit, the poison struck him, and he gave up the ghost. The people were mute with horror, at beholding that highest of crimes the murder of a bramin. The prince was alarmed at this horrid event, he cursed his fate, and it occurred to him that the parrot had brought him this ill fated boon, wishing to cause his

* This and similar vulgarities are continually met with in the Telugu poems: even in the Ramayan and the Vasu Charitra: and such we find in Spenser and Shakspeare.

perdition. He exclaimed death has not befallen me but a sin worse than death: surely this wretch is not fit to be called a parrot! let me cut the sinful miscreant to pieces. He therefore sent for the jewelled cage, and filled with fury, grinding his teeth with rage, cruel as a forester who destroys birds, he seized the parrot in his left hand, and without considering what he was doing, while it screamed out he slew it.

Now listen. There was in that town an actress who was now aged. She had in her youth been celebrated for her talents in the dance and song so that she was amply patronized. But now that she was old, her juniors were incessantly flying at her, and tormenting her and smiting her, so that they drove her out of the house, and she took refuge in the next street. She reflected, surely, in my youth mere words and harmonious notes obtained me large gain: for the applause of the multitude was lavished on me. Now my fate has made all men my foes, and as the proverb says "instead of dealing in roses I am come to selling faggots." Who in the world will endure to live after losing the fashion? It is better for me to resolve to die by partaking of the celebrated poisoned mangoes so that I may at once relinquish my life.

Full of these thoughts she at midnight stole to the enchanted mango-tree, and out of the piles of fallen fruit she picked out one, and devoured it. She instantly found herself a girl of twelve years old: she was greatly delighted, and as the eastern sky reddened towards dawn she returned home dancing and singing, as she passed through the high street so that all who saw her were filled with astonishment. This was reported to the king who was incredulous. But when he saw this dansatrice in the bloom of youth he called her to him, and by the hands of his servants collected the fruit, and in the presence of the people delivered them to his ministers who took them, and distributed them to all. Hereupon venerable couples who had been wedded for a century were miraculously restored to youth.

But when the king reflected on the good brought about by the parrot he was filled with grief at the folly he had committed. Alas, thought he, I reared it as a son, and then sitting at my ease, in perfect coolness I have broken faith, and slain my hapless favourite. So saying he drew his sword, and gave up the ghost.*

And when she thus saw her lord perish before her face, the royal dame accompanied him in death.

Therefore reflect that if you slay your son as this king slew the parrot without due consideration, you will repent the deed.

* Suicide is perpetually mentioned in the Hindu writings as no sin.

THE STORY NOW CONTINUES AS FOLLOWS.

Saranga's mother now approaches the king weeping, and touching her lord's feet, and praying that her son may be delivered to her that they may depart from the country. The king not relenting she entreats the intercession of the spectators, praying a sight of her son. This is granted. The interview is very finely delineated. The arguments used by her friends to console her. Evening now coming on, the executioners separate him from his mother, and convey him to the fatal spot in the wilderness. Description of the forest. He prays their mercy in vain, and at last they cut off his hands and feet. 411-472.

He is left to die: but his senses return: his lamentations: followed by reflections that these evils must be the result of sins committed in a former birth.* He hears a voice from heaven confirming this idea: stating that in a former stage of existence there was a king who had two ministers named Jayanta and Sumanta. To the latter the king entrusted supreme power, and the former wishing to be avenged, bribed one of the queen's handmaids to place his rival's slippers under the royal bed. The troubles that result from this fraud. The blameless Sumanta is put to death. His son was in a succeeding birth thy father and Jayanti is thyself: hence result these torments. This Chitrangi was the treacherous handmaid. Thus spoke the heavenly voice.

It now fell night. The horrible plight of the maimed wretch. His groans were heard by a (Siva-yogi) hermit, who lived on the mountain. He put on his (*yògavága* †) shoes of swiftness, and was transported to where the victim lay. He accosted him, enquiring who he was. He relates all that had happened, and a long conversation terminates in the lopped limbs being miraculously restored.

It now dawned. The executioners returned to the king, and related regarding the voice heard in the sky: the king's anguish—he sends for Chitrangi who persists in her assertions, and requests that their tale may be proved by producing the amputated limbs. At this moment the heavenly voice was again heard, revealing the truth, and establishing the innocence of Saranga Dhara. Chitrangi is put to death with universal execrations. After sundry miraculous occurrences Saranga Dhara is restored to his father, and at his prayer Chitrangi is likewise raised to life. The poem concludes with a description of general rejoicings. Saranga Dhara renounces the worldly state, and retires to the wilderness as a hermit, where he acquires supernatural powers. The poet concludes by stating that he wrote this poem as an improvement on the version written in *stanzas* by an older bard.

* Here again we meet with a principle that pervades all the writings of the Hindus: "the result of acts committed in a former birth" being referred to as the one solution of all evil or good which we meet in this life. It implies a vague reference to the equity of providential dispensations.

† These are described as seven-league boots worn by hermits on active service.

In this short abstract of the tale, it has been necessary to omit the romantic incidents, various conversations, moral precepts, and poetical descriptions which every where adorn the pleasing original. It must be acknowledged that all the popular "novelists" are of tedious length, but their minuteness of description furnishes the student wi'h an ample stock of phrases, and as is elsewhere noticed spares him the necessity of following the native fashion in committing versified vocabularies to memory.

The next extract is borrowed from the Lila (Prabhu Linga Lila), or HISTORY OF ALLAMA some details regarding which may perhaps be given in another essay. It is an allegorical poem much in the style of the Faery Queene. The metre is dwipada, and another author has in modern times put the same story, nearly word for word, into the *stanza* metre. That version is in point of eloquence far inferior to the more ancient poem.

In the present canto the poet describes the birth of Maia (Phantasy or Cybele), the goddess of delusion: that is, NATURE: who in this allegory is supposed to be born in human form, for the purpose of trying her temptations upon Allama, or "the virtuous man" (the Hercules of Prodicus which Lowth and Shenstone have versified): she is ultimately enamoured of him, and dies of hopeless love, on his vanishing from her grasp. Allama, a human appearance of Siva (or Saturn-Osiris) is described as the god of beauty and wisdom (Apollo-Adonis), and in the fable regarding Maia we may trace an analogy to that regarding Venus and Adonis.

LILA—OR PRABHU LINGA LILA—CANTO III.

There is a country named Belagoli lying on the south of *Méru*] king of hills. All who dwell in that land are worshippers of the Lord of all: all of them are veracious. All the heroes that dwell there are steadfast in the ways of uprightness; all are noble, all are virtuous: their virtue proceeds in due course nor does any sinner ever tread its streets. In the midst of this land is a city bright as the sun; can we call it the abode of the goddess earth: or shall we call it her face? Its name is Banavasi.*

To narrate its splendour is beyound the powers of Bramha! Its groves are filled with blossoming mango trees and areca trees; with budding lemon trees and plaintains; with the fruiting artocarpus (jaca) and citron. Also the charming asóca and (málúra) oak trees with the (sarja) pine tree and the date; the golden champaca: the (vacula) mi-

* In the Soonda country, on the south west coast of the Peninsula.

musops and (bhunja) the flowering birch: these and thousands more filled the fragrant groves. These were tenanted by the linnet, the parrot, and the redbreast in endless flocks: they sported around, singing merrily. The fragrant Kétaki, the oleander, the laurel, the (pagada) coral and giant jessamine with the spherical species of jessamine and mountain roselle, and larger *curuvinda* and the (párijáta) amaranth: the various jessamines called *vásantica* and viravádi *jáji* and the smaller jáji and the (chámanti) orange-marigold; for at all seasons these flowers call upon the devout to worship their God. They blossom without intermission, and perfume the breeze as they lie scattered through the parterre. The piazzas therein erected were plaistered with musk, and around them were spacious streets: these were adorned with dolphin crests and gay garlands which were daily renewed throughout the town. And the floors were sprinkled with *gomayam* dissolved in essence of sandal shedding a sweet perfume around. And who is it that, tipsy with these intoxicating scents wanders around the banks of the lakes, and stealing upon the sleepy-eyed maiden touches her bosom with glee? sportively tossing up her veil he plays with her jetty locks he takes every liberty,—he stirs the spirit of merriment; for, roaming like a lover through every alley of the town, welcome to every cheerful heart he strolls at will? It is the vernal breeze, Vertumnus himself.*

* * * * * * * *

'The height of those bastions the depth of that fosse? angels may 'tell the one and demons† the other! no other can comprehend it who 'then can even imagine the loftiness of the towers, and sky-touching 'pinnacles?

'The roars of the elephants, the clang of their bells; the gaudy 'heralds, and their fluency of tongue: the resounding cries, the min-'gled voices and echoes, and the clamour of the people who can des-'cribe?

* * * * * * * *

The poet now describes the king named Mamacara (Egotistes), and his wife named Mohini (Formosa) whose child is (Maia) Illusion. He then proceeds as follows:—

'Now Egotistes and Formosa were delighted at their little daughter 'Maia, and could not keep their eyes off her; all their thoughts were 'bent on her; never was her figure out of their mind: they would clasp 'the babe to their bosoms, nor would let her grieve; they laid her at 'their side, and could not keep away from her a moment and surely,

* In this passage the other version is bombastic.

† In his Christian poem, the Tembavani, Beschi introduces such flowers of rhetoric into his Tamil composition.

'cried prince Egotistes this cannot be a child of ours! it must be a fairy 'babe! let then her name be Maya.

'The nurses gave her the breast, they anointed her head and bathed 'her nicely, and then wiped her dry, and laid her on the lap; they gave 'her butter and honey, and touched her eyes with collyrium: they put 'a mark on her forehead with ashes, for luck, and spread out a clean 'sheet, in which they affectionately laid her: then with loud voices 'they began the lullaby, till she fairly fell asleep. The cradle was 'richly adorned with gems that reflected her image; which she took for 'another child, and playfully stretched over her hands towards it: she 'gently passed from her mother's arms to the arms of her father: and 'prettily embraced her papa's neck, all in a tremble with delight as 'they gave her kisses, and she played about full of glee. They deck'ed her feet with fair rings and anclets which rang as she stamped in 'tottering along. Then they put rings and gold bracelets on her wrists, 'and a pretty gold fig leaf adorned her forehead. They next put on a 'gold necklace of the oleander petal fashion with rows of large beads of 'fine gold.

'Thus completely decked out, she most merrily sported about with 'the other girls: while the hearts of her parents, nurses and playmates 'were filled with joy. Thus did Máya pass her infancy. All others 'were astonished at her cleverness, and praised her with a thousand 'mouths. But very shortly Máya (perfect as a teacher of gymnastics), 'might have given lessons even to elephants and swans in elegance 'of swimming gait. In musical melody she rivalled the linnet and the 'nightingale; in prettiness of accents she might have had parrots for 'pupils. After a while she began to bloom in youth: for the tricksy 'maid often used childish words but kept her thoughts to herself: she 'soon learnt to roll the eye, and use the artful beckon with the hand; 'or with the frown of anger on her brow, and frolicksome fun in her 'breast. Those who eyed these intoxicating charms at once turned 'fools, and fell in love with the girl. Then as she attained fuller ma'turity, her manners were formed! what a bloom, what loveliness, 'she displayed! what a grace in walking! that delicate waist, that 'swelling bosom! that forehead! those swimming eyes! those elegant 'hands, that smiling countenance! those flowing tresses! surely in 'these charms the sweet Máya outshone all other women!

'Now the king built a palace as the abode for Máya [Delusion] who 'holds the universe in her power. He raised the walls blazing with 'gold and rubies; therein he placed courts, abodes, streets, and great 'storehouses; he encouraged all trades, he appointed men skilled in the 'elegant arts to teach poems and plays to the damsel.

'In the next place the Prince Mamacára contemplated disposing of 'his daughter in marriage.' &c. &c. &c.

In the next extract is described the death of Maia for love of Allama (or Atys—Saturnus). Her companion Vimala (a personification of *Purity*), dies with her.

CHAPTER VIII.

'But when Allama thus vanished, Máya was filled with the deepest 'affliction; she cast her eyes on her playmate Vimala and exclaimed, 'with downcast looks—"Now with what grace can I venture to appear "in the presence of [Parvati] the Queen of Heaven: how can I approach the courts of Hara (Jupiter) and his awful spouse? Surely "I alone out of so many attendant ministers ventured on this arduous "task! Alas sad Destiny!"

'Thus exclaimed she, grieving in her very soul: but the king of men 'now entered the grove in quest of his beloved daughter; after some 'search he found in a remote spot, with her handmaidens, his child, all 'woe be gone and sunken with grief. The prince and his spouse affec'tionately raised and embraced their daughter, exclaiming, "What 'dreadful grief, my darling has Siva poured on thee! There is even now "a mountain chief, son of a king, who has sent to demand thee in "marriage, but thou hast to-day thrown thyself away, and become the "victim of a minstrel! how canst thou have fallen into this sad state? "How many counsels has thy mother given thee in vain at midnight! I "am leader of all the hill chieftains, and thou dost not even think on me "my sweet babe! Did ever any body ramble in this way like a rover "from house to house, and break the established laws of custom? or "do they ever thus depart from the commands of their parents? It is "too late! what is the good of building a bank after all the lake has run "dry? come, arise, mount into thy litter, and return home."

'But Vimala viewed the king, and in bold accents thus replied: "She promised the Queen of Heaven that she would in a moment seize, "and bring him to her. Such were her words, uttered in the presence "of Siva, before she descended on earth; and she has failed of accom"plishing what she swore to do. She and I will immediately depart to "Olympus. Have done then with these vain lamentations. Return "to the City. Fare ye well!"

'She said and Vimala and Maia instantly took their way to the "Olympic regions.* But the queen and her lord were overwhelmed 'with grief, they groaned and cried saying "Alas my daughter, my 'daughter!" rolling on the earth they were defiled with dust, wallow-

* A phrase understood to denote sudden death: probably suicide.

'ing and wailing, "thou art gone," cried they—melting, distracted 'they cried alas alas; agitated with anguish and beside themselves, 'wringing their hands, and beating their breasts, Alas cried they, my 'beauty, my charmer, my own delight, my sister, O shall the day ever 'come when I forget thee?'

'Thus cried they still in their affliction, when the noble Ahancára '(the king's minister) approached them. Why exclaimed he, "why "this grief when it is too late! is it possible for mortals to avoid the "doom fixed by the deity? surely the fair Maia dwelt among us for a "certain object, and she is now gone; she is no more a daughter of "yours: surely you have heard this in the last words of Vimala; then "why should you grieve any longer. If we do not return to the royal "dwelling the hearts of men will be filled with uneasiness: all our "dependants will quit our banners, and will betake themselves to other "princes."

'Such were his counsels to Mamacára, lord of men, who lent an ear; 'he brought him back to the palace, where he continued to rule the 'land prosperously.

'Meantime Maia and Vimala stood, "there" in the presence of 'Sancara's awful Queen: they hung down their heads and drew lines* 'on the floor. The goddess at once perceived that Allama had not fal- 'len in the hands of Maia: her gay cheer vanished, and she drew a 'deep sigh: the daughter of Olympus did not approach her lord, but he 'perceived all the fact: forthwith he proceeded to the dwelling of his 'fair spouse, and with overflowing affection consoled her: then, not de- 'sisting from his first intent, the vanquisher of Pluto thus addressed 'the dame, in words that conveyed a double import. "It is easy "enough to snare thunderbolts, and roast them like larks; it is easy to "handle serpents and fiery dragons; to seize and draw out the fangs "of death; but where shall we find him on earth who will be able to "tempt and conquer Allama?† what is woman? and what is woman's "resolution? But never mind; the affair is over, O daughter of hills! "forget the grief that has filled thy heart."

'Thus he addressed her; but she replied saying—when I sent Maya 'on earth in my stead, surely thou wentest thyself in the guise of 'that Allama, and thus hast thou succeeded, and I have lost: now pray 'be quiet.‡ He replied, listen Parvati, you had the presumption to 'concentrate all your (tamasam) powers of delusion, and moulded it 'into woman; her you sent to earth, and you have brought this ridicule

* With the toe: a Hindu expression of regret.

† Allama being an emblem of the deity.

‡ The Homeric simplicity of phrase gives an odd appearance in a translation, here as elsewhere.

'on yourself. Him who is endowed with the highest innate bliss you 'looked upon as a mere mortal. Can delusion or illusion contend with 'him? Is he subject to any of the (cáya guna) ties of the flesh?

'But the queen listened to the reiterated arguments of her spouse, and 'now wearied she replied thus alas what avails my much speaking? 'after defacing me you present me a mirror! what am I that I should 'lay the blame on you: thou art the very fountain of goodness: then 'pardon me.

'The god gazed on his fair spouse, and kindly said, be patient if pos-'sible this once: I will myself heal all thy grief. She arose and rever-'ently saluted him, and with deep devotion she folded her hands and thus replied: In what way wilt thou do away this affliction?

'Then to the goddess replied that chief of gods.

'Send down to earth that pure spirit of (sátwica) benignity which 'is in thee: let her be filled with faith and self denial, being entirely 'released from the law of works. For wherever dwells faith (bhacti) 'there shall the lord (Prabhu) abide. Therefore shall he voluntarily 'draw near to where thy Benign spirit (satwica cala) dwells, he shall 'shew forth his own form, and full of grace shall he bestow exceeding 'gladness on the damsel.

'The goddess listened and replied great is thy goodness. Forth-'with she sent the spirit of love (satwica cala) on earth, and now was 'restored to heartfelt comfort.'

What has now been cited from the poems written in couplets may suffice to shew the general turn of that class of literature: a few specimens of those poems which are framed in stanzas may perhaps be produced in a future paper. Indeed the *caviams* are like the odes of Horace written in an elevated style which cannot be competently represented in a prose translation, unless we were to use such a dialect as is found in Darwin's poems.

The higher branches of poetry in Telugu as in other cultivated languages, can seldom be enjoyed by foreigners. Indeed among natives few alone have by long study become familiar with all the refined phrases, the historical and mythological allusions that occur. And we may reasonably entertain a doubt whether so complete a knowledge is worth the toil of acquisition. But those popular authors who have furnished the extracts now made, are, after moderate application easily comprehended, and will furnish an ample stock of useful and agreeable reading.

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V.—*Sixth Report of progress made in the Examination of the* Mackenzie MSS., *with an Abstract Account of the works examined.—By the Rev.* William Taylor.

A.—TAMIL.

a. Palm-leaf manuscripts.

1. *Bhágavatam,* No. 12—Countermark 18.

This manuscript, with another, incomplete copy were adverted to in the beginning of the fourth report; and the four first books were therein abstracted.

The following is a continuation.

Fifth book, or *Cándam.*

The story of the eldest son of *Svayambhuva manu,* is begun by the narrator. The name of the said son was *Priyavrata.* He was taught by *Náreda,* and declined to comply with his father's request, that he would solicit possession of his father's kingdom. *Brahma* came and expostulated with him; on which he consented to be crowned, or instituted, to the kingdom. On devolving his charge *Svayambhuva* retired to the *tapóvanu,* or wilderness of penance. *Priyavrata* married a daughter of *Visvacarma* (artificer of the gods), and had ten sons. Three of them were devout, and obtained final emancipation. The other seven sons acted agreeably to their father's directions. *Priyavrata* had three other sons, by another wife. He reigned a long time. A celestial car, sent from *Vishnu,* came down. Mounting this car, he surrounded the mountain *Maha-Meru* seven times, in seven days. The tracks of the wheels formed the seven seas; the intervals between them are the seven great *dwipas,* or islands. The name of the seas, and intermediate *dwipas* are given: (see Or. Hist. MSS. vol. 1, p. 48). The seven obedient, and secular, sons of *Priyavrata* were instituted to the kingly rule of the said seven *dwipas.* Subsequently *Priyavrata* obtained beatification. *Agni druhva* married, and had nine sons by *Purvasidhi* his wife, who was a special gift from *Brahma;* and who, on dying, returned to the *Satya loca,* the highest orb, or *Brahma's* world.—The nine sons aforesaid, ruled over nine divisions of *Jambu dwipa,* which divisions were called after their names. *Agni Druhva,*

inconsolable for the loss of his wife, had many great sacrifices performed: and at length rejoined her in Brahma's world. *Nabhi*, the eldest of the nine, performed a sacrifice, directed to *Vishnu*, for the sake of offspring. *Vishnu* appeared, and gave him a promise that he would himself be born as the son of *Nábhi*. This promise was accomplished in the birth of *Rishabha* (always reckoned among the subordinate incarnations of *Vishnu*, and a leading personage with the *Jainas*). Both father and mother relinquished their rule; giving it into the hands of *Rishabha*: they then retired to an ascetic life, and finally were beatified. *Indra* gave his daughter in marriage to *Rishabha* (symbol for a felicitous marriage). *Bharata*, and one hundred other children, were born; and as *Bharata* ruled the country, it was called *Bharatacandam* (the country south of *Himalaya)*. The different portions of his sons are specified. Some of them performed ritual ceremonies, and became Brahmans. *Rishabha* relinquished all his possessions; and went away, followed by his children. He advised them to leave off the use of ceremonies, and to practise justice, and charity, with similar instructions; which (in their place) are of superior character.

Paricshit, interrupting the narrative, enquires of *Suca* why *Rishabha* relinquished his possessions. *Suca* replies, detailing those reasons; the tendency being to enforce such a renunciation. Death of *Rishabha*. Account of *Bharata*. He was guilty of misconduct; and, as the result, in transmigration was born as a deer. Doing penance, his former sense returned; and, in another transit, he was born a *Brahman*. A chief being without children vowed to present to *Durga*, a *Narabalí*, or human sacrifice. *Bharata* was caught by the people, sent out for the purpose, and by them was forcibly carried to a shrine of *Cáli*. He was painted red, and covered with red flowers, and other ornaments. The said *numen* was greatly incensed; came forth; drew her sword; cut off the heads of the people, who had brought the purposed victim; danced about, holding their bleeding heads in her hands; drank the blood as it streamed from those heads; and then retired within her dwelling, satisfied. The *maha purusha* (or Brahman) thought that certainly *Vishnu* was present (as a preserver), and then retired to the fields again. It so happened that a king of *Sindhu-desam* became desirous of going to visit a sage, who had obtained high repute for teaching the *tatva* system. The people of this king pressed the before mentioned *Brahman* as a palanquin bearer. He meekly yielded; but, in the effort, was quite inferior to the other bearers: and could not carry his burden even, or without jolting. The *raja*, being displeased, enquired why the other palanquin bearers com-

plained so much of the newly pressed bearer. The result led to a discourse on spiritual matters, between the *raja* and the *Brahman.* The *raja* was so much pleased with this discourse, that he took the *Brahman* to be his *guru,* or spiritual preceptor. The latter avowed himself to be *Bharata,* recounted his past history; and then taught the king of *Sindhu,* spiritual knowledge, turning on the vicissitudes of earthly things. The *raja* returned to his own country. The *Brahman* (i. e. *Bharata*) left off keeping the fields, which office had been assigned to him by his former master. He now wandered about; passed the remainder of his life without control; and at his own pleasure.

The posterity of *Bharata* follows in succession. Afterwards there is a full description of the seven *dwipas,* seas and other matters, according to *Pauranical* geography. The channel of one river is filled with flowing juice of mangoes; they who partake of this *amrita,* or nectar, overcome death. The account of the different regions is full and particular. In *Pushcura-dwipa* the day and night is said to consist, taken together, of a year (which of course is the case near the polar regions): no distinction of caste is observed there. Beyond is *Chacravali-giri* (apparently the north pole), and beyond that a golden country (region unknown). The sun goes round *Chacravali-giri*; and, in that land, reverses its order of rising and setting.

A transition is then made to the stellar sky, or world of the stars. The inferior worlds are noticed; their rulers and inhabitants are described, down to *Naraca.* A description of the pains, penalties, and severe inflictions visited on the guilty in *Naraca* is given. It is minute, circumstantial, revolting; and it fails of the awful sublimity of the Christian revelation, on this point, as to simplicity and grandeur: inasmuch as the details sometimes verge on the ludicrous; and, in other instances, are shocking, without being impressive.—With the enumeration, on this subject, as indicated, the fifth book concludes.

Remark.—Upon the slightly altered plan of my reports, the abstract of one book, at a time, may be proportionably sufficient. According to inferences by Sir W. Jones, *Svayambhuva manu* has been identified with Adam, the progenitor of mankind. That such, however, is the reference of the name in this document I greatly doubt: the facility with which the same names are applied to different persons, at distant places, and periods of time, may easily reconcile any discrepancy. That *Priyavráta* is said to have had ten sons, I desire to be noted; without, at present, drawing any inference therefrom. As to further, and following matters it does not seem needful for me to make any special annotation.

2. *Sevendhi St'hala puranam*, or legend of the fane at Trichinopoly, No. 25—Countermark 34.

This document is divided into thirteen sections, a brief abstract of which is herein added.

1. The usual invocations, and panegyric of *Ganésa*, &c.

2. The glory of the hill on which the fane is built. Even wild beasts lived in harmony on it, and sacred *rishis* dwelt there. *Gautama-rishi*, coming to visit them, narrated, at their request, the excellencies of the place, as he had received the statement from *Sanatcumara*, who had received the same from *Subrahmanya*. *Trisira* dwelt here; and from him it derived the name of *Trisira-mali*. The rock is a splinter from *Cailasa*, originating in a quarrel between *Vayu*, and *Adi-seshan*. It acquired the name of the southern *Cailasa*.

3. The penance of *Brahma* at this place: the legend of the lie told by *Brahma*, as related in the *Scanda purana*, and *Arunachala puranam*, is introduced; and *Brahma* being doomed by *Siva*, in consequence of that falsehood, was told that the evil denounced would be removed by doing penance on this hill.

4. The legend about *Agastya*, *Gautama* relates a conversation between *Siva*, and *Náreda*. The latter of whom told the former that the *Vindhya* mountain was not to be compared with *Trisira-mali*. *Agastya*, being sent from *Cailasa*, was directed to visit this hill, and afterwards to proceed to *Pothaiya-mali*. *Agastya* accordingly stamped on the *Vindhya* mountain, with his pilgrim's staff, reducing its level thereby. He afterwards visited *Trisira* hill, and then went on to *Pôthaiya-mali*, in the extreme south.

5. The legend of *Indra*. The celestials of *Indra's* world, being unable to bear the oppression of *Chemban*, an *asura*, complained to *Indra* their chief; who, under directions from *Siva*, killed the said *Chemban*; and then, by doing penance at *Trisira-mali*, effected an expiation of the crime.

6. The legend of the *tirt'ha*, or sacred pool. *Uma* asked *Siva* the place of this retreat: in reply he designated *Trisira*, a hill. She then desired that a reservoir of water might be formed there; and *Siva* directed *Ganga*, in his hair, to provide one; which accordingly was effected, in which *Uma* afterwards bathed.

7. Legend of the sacred town. *Gautama* tells the *rishis*, that *Trisiras* was one of the relatives of *Rávana*. He came to this hill; and there, of his own accord, rendered homage to *Siva*. He built a shrine,

and a town, at the foot; surrounded by walls, and battlements. He received from *Siva*, at his solicitation, the privilege of having the rock, and town, called after his name; and after residing there some time, he died.

8. Legend of gifts obtained. *Gautama* informs the *rishis*, that *Rama-Chandra, Hanumán*, the five *Pándavas*, and many other distinguished persons, paid homage here, and received the benefits which they sought: in consequence of which the fane became highly distinguished.

9. Legend concerning *Sára-maha-muni*. A certain *Brahman* did penance at *Himálaya*; and, in a subsequent transmigration, was born at Benares. After other changes, he was born as *Sara-maha-muni*; and, doing homage at this place, acquired the gifts which he desired; whence this place became highly distinguished.

10. Legend of *Sura vátittan*. One of that name visited this celebrated hill, with a great number of followers; and, after erecting various buildings, he ruled here, as a district chieftain.

11. The same subject continued. States the marriage of the same person, with a woman of foreign birth; after which he added other buildings, and continued his rule.

12. The destruction of *Uriyur*. *Sara-maha-muni*, before mentioned, had a garden planted with the *Sevendhi* flower plant. A person was in the habit of stealing these flowers; and presenting them to *Parantaca** *Cholan*, the king. The *muni* one day detected the thief, and complained to the king; who took no notice. In consequence of this neglect the ascetic performed penance, and made application to *Siva*; who sent a shower of mud, which destroyed *Uriyùr*. The king, with his wife, fled; his wife was pregnant, and cast herself into the *Cáveri*. The King, fleeing on horseback, was overtaken by the mud-shower, and killed. By the favour of *Siva*, his wife was taken out of the *Cáveri* alive; and was entertained by a *Brahman*. She was delivered of a son in *Jambu-divu* (a small island in the *Caveri*), who was brought up by the *Brahman*. When search, by means of an elephant, was made for a king, the elephant found out the young man; and put the usual wreath of flowers on his head. He was installed as king, and as the Brahman had marked his feet with charcoal, he acquired the name of *Cari-Cála-Cholan*.

13. The legend of *Tayuman*. The origin of *Caveripum-patnam*, is ascribed to certain women casting their garlands into the *Caveri*. That town was very flourishing, and a *Chetti*, or merchant, was especially distinguished. He had a daughter, who was married to a person at

* "The destroyer of foreigners," an epithet; other books, gave him other names.

Trichinopoly, named *Tana-cuttan.* Her father named *Athan cuttan,* died, when she was in an advanced stage of pregnancy; and as she had no attendants at the time of her delivery, *Siva* himself assumed the shape of a mother, and performed the office of *accoucheuse;* which the celestials beholding showered down flowers. Whosoever pays homage to this same *Siva,* will receive all manner of benefits.

Remark.—The manuscript is complete, and in very good order. The earlier legendary portion points to a time when there were no Brahmans in the country; when it was a province of *Lanca,* or Ceylon (in all probability connected therewith by an isthmus); and antecedent to *Rama's* invasion: which also apparently preceded the visit of *Agastya,* who first led on colonist *Brahmans,* and directed them to various localities in the *Peninsula.* The mythological treatment of *Brahma,* can hardly escape remark: however that I pass by, as a common matter in *Saiva St'hala puranas.* The 10th section would be obscure, but for a glossary afforded by a *Mahratti* manuscript, written at Tanjore, and abstracted in my Fifth Report. By its help *Sura vátittan* is identified with the first of the series of *Chola* kings. The 12th section has heretofore received abundant illustration: see, in particular, remarks on the *Chola patayam* in my Second Report. The 13th section upsets altogether the fiction of *Tayuman-nalli* as a founder of the shrine: and enables me to perceive, that the wealth of the famous merchant of *Caveripum-patnam* (see Tamil MS. book No. 1 Third Report) when renounced by himself went, in a great measure, to this place; so that *Siva,* by means of his *Brahmans,* became administrator to the effects of the bewildered man, when unable to take charge of them himself. Such, in my view at least, is the interpretation of the enigma of *Siva* becoming "a nourishing mother" designated by the term *Tayumàn,* or the Sanscrit *Matri-bhuvésvara.*

3. *Mahratta* and *Tuluva-desa charitra,* or, an account of the *Mahratta,* and *Canara,* countries.

No. 234—Countermark 57.

This manuscript consists of loose leaves; for the greater part unconnected. At the first reading it disappointed me; and was laid by. But reading it over after having abstracted the *Carnataca rajakal,* this book appeared to possess great similarity, in such fragments as were at all connected. On comparison, it was found to consist of portions of

another copy of that work. By means of it I have been enabled to complete the restoration of the larger lacune in the *Carnataca rajakal,* which is now complete, with the exception of only one palm-leaf, not recovered.

Note.—The leaves, and writing, are recent in appearance; a little injured by insects, which is of no consequence, as the work is otherwise nearly complete.

4. *Mahrattiya rajakal, Tuluva rajakal, kyfeyutt*; or account of the Mahratta, and *Tuluva* kings, No. 235—Countermark, wanting.

The manuscript has not the beginning: since according to the number of the palm leaves, 26 are wanting; the eight following ones down to 34 are regular; but the whole is a mere fragment. The 27th alludes to kings of the *Cali-yuga,* it contains the mention of *Hara-Pratápa-deva rayer,* and his descent is deduced from *Janamejaya.* The manuscript has a discrimination of the five countries, and languages, comprised under the term *Pancha-Drávidam.* From *Ramesuram* and *Malayalam* to *Calahastri* is the Tamil *Dravidam.* From *Calahastri* to Ganjam is the *Telinga Dravidam.* From Mysore to Golconda is the *Carnataca Dravidam.* From *Golconda,* to *Puna, Sattara,* &c. is the *Mahrashtira Dravidam.* From *Sattara* and *Puna,* to the southward of Delhi is the *Guzeratti Dravidam.* The five *Gaudas* are then defined. Mention of the race of *Janamejaya* down to *Sarangad'hara* the last of that dynasty. Four names are given as the dynasty of the *mantri,* or minister, of *Vicramaditya.* There is then a mention of some kings of the *solar* line: with the name of *Vicrama* at the close; apparantly meant for *Vicramáditya. Sáliváhana* is next mentioned, with an interval of more than 2000 years; not accounted for in the dates. *Bhoja raja.* Transition to *Cari-Cala-Cholan,* and his works on the *Caveri.* Other *Chola rajas*; one of whom is said to have ruled as far as to Ougein. Special notice is taken of *Rajendra's* endowment at *Tiru-ottiyr.* He is slso represented as having patronized Tamil literature: contrary to other documents be is represented as the father of *Adondai.* However both *Rajendra* and *Kulottunga* (elsewhere termed father of *Adondai*) are both titular names. *Sundara-Chola* is the last one mentioned.

Remark.—This manuscript I also find to be a fragment of the *Carnataca-rajakal,* and it is of no consequence; as that portion is complete in the restored copy. What remains of this fragment is damaged. The whole does not bear all the usual marks. But from the consecutive Nos. 234 and 235, and the title taken together, I conclude that these two copies

are those entered in Des. Cat. vol. I. p. 200, art. 13, under the head of *Tuluva desa katha.*

5. *Cusala nátaca,* the drama of *Cusala,* the son of *Rama-Chandra,* No. 113—Countermark, wanting.

The former portion of this manuscript contains the said drama, entirely in verse of the *virultam* kind. It is complete, and in good order.

The latter portion is a prose version of the adventures of *Nala-raja,* according to the episode in the *Mahabharata.* It is in good order, but not quite complete at the end; a few leaves only remaining to be written.

Another copy of the drama No. 114, ought to be in the collection, according to the Des. Catal. but it is not now to be found therein.

6. *Cusala-nataca,* the same, No. 115—Countermark, wanting.

This is a copy of the drama only, in verse, with a prose version, and some musical indications, as is gathered from the remains; but the whole manuscript is so greatly injured, by insects, as to be almost destroyed, and quite irrecoverable.

Remark.—The story of *Nala* needs here no further observation. The drama is founded on the birth of *Cusala* and *Lava,* sons of *Rama* of *Ayodhya*; of course with the additions and inventions customary, in dramas.

Note.—The drama is entered in Des. Catal. vol. 1, p. 213. art. ii.

7. *Agastyar vaidyam,* a medicinal work by *Agastya,* No. 79—Countermark 242.

This work contains 1500 stanzas, on medicine, ascribed to *Agastya.* The book is complete, and remains uninjured.

It is entered in Des. Catal. vol. 1, p. 258, art. i.

8. *Vaidyam Munnur,* No. 88—Countermark 248.

This work on medicine, also ascribed to *Agastya,* should contain 300 stanzas. This copy is however not complete: at the beginning thirteen leaves are wanting. From the fortieth leaf, five others are deficient. It is thenceforward regular to the eighty-seventh leaf, and the remainder, at the close, is not found. It is otherwise in good order, and preservation.

It is entered in Des. Catal. vol. 1, p. 250, art. v.

9. *Tiru-mulur-Vaidyam*, No. 92—Countermark 255.

This also is a medical work, complete in sixty-two palm leaves, and not injured by insects.

It is entered in Des. Catal. vol. 1, p. 260, art. x.

10. *Vaidyam Nápattettu*, or forty-eight stanzas on medicine, No. 91—Countermark 251.

A tract on medicine, ascribed to *Agastya*, which should contain 48 stanzas; it wants the last one: the remainder is complete, and in good order.

It is entered in Des. Catal. vol. 1, p. 259, art. vii.

11. *Ullam udiyan*, No. 67—Countermark 230.

12. Another copy, No. 68—Countermark 229.

These are copies of a work on astrology and divination. The literal rendering of the title is "the possessor of the interior," whether it relate to thought, mind, or purpose. The title is also that of an individual to whom the work is ascribed; but I rather think that, the author's real name being unknown, the title of the work itself became in progress of time applied to him, as a distinctive appellation. The work is popular; and takes in a great compass of matter, on the subjects to which it relates. These are the influences of the planets; the effects of the signs of the zodiac; and similar matters purely astrological: and in divination, it teaches the art of discovering things lost, or things concealed, and of explaining to persons what they may hold folded up in their hand, or what may be the secret purport, or intent, of their minds. In a word, it is on the occult sciences, for which Egypt and Chaldea of old were famous; which rule in this country, at present, with absolute sway over the superstitious minds of the people; and of which remnants are found in every country of the globe.

The composition of these two books is mingled verse and prose; but the latter predominating. I regret that I cannot make the subject one of study: even my examination of such a work must necessarily be superficial. But I do not hesitate to state my opinion that, subordinate to a good knowledge of the history and mythology of the Hindus, the next thing, in point of importance, is an intimate acquaintance with their occult sciences. By the means of this work, and similar ones we may acquire a better knowledge, than we as yet possess, of the Hindu celestial sphere; absolutely requisite in order to solve the astronomical

enigmas which abound in their historical and mythological works; but more than this we may get at the key which unlocks the popular mind. Strong as may be the bond of caste; powerful as may be the spell of mythological fable; neither are stronger than the astrological conjuration, which holds the people under a charm, more potent than that effected by Prospero's wand; and has in past ages, even down to the present, rendered high and low orders alike subject to the astrological Brahman: not daring to stir a step, or do a single thing, of any moment, without his permission first obtained. So varied and combined, so intricate and confused, are the various connected parts of astrological lore, that a state of passive inaction is the only safe position for a genuine *Hindu*; and his guide can shew cause, or reasons, almost at his pleasure to cause him to move, or to stand still. That this despotic influence should be known, and expounded, for the benefit of rulers, legislators, and teachers, surely must be highly desirable.

As to the condition of these two copies, No. 67 is incomplete; some palm leaves in different places, to the extent of forty-three, are wanting; neither is it complete at the end. It is a recently copied work; but notwithstanding is slightly touched by insects. No. 68 is complete, and wholly uninjured: the leaves and writing are quite recent.

NOTE.—Both copies are entered in Des. Cat. vol. 1, p. 254, art. iii.

b. MANUSCRIPT BOOKS.

Manuscript book, No. 15—Countermark 227, *Subrahmanya Cadavul*, an astrological work.

The title only means "lord Carticeya;" apparently technical, in consequence of the invocation being not addressed, as most usual, to *Ganesa*, but to *Cumara*. The *rishis* are honoured, the plan of the work is given, and then a variety of astrological particulars follow as to friendly, and unfriendly, aspects of planets, influence of zodiacal signs, lunar asterisms, and similar matters, in somewhat full detail. The work is a thin folio. It is cleanly written, on strong country paper; and is in perfect preservation. It is also complete.

An entry occurs in Des. Catal. vol. 1, p. 254, art. i.

Manuscript book, No. 19—Countermark 228, *Sarvardha Chintamani-jyotisha,* a work on astrology.

This book on the same general subject, does not seem to be complete; since only about one-third is written on, and the break appears abrupt. The ink is a little pale; but the paper good, and in good preservation.

Abstracts of such works are impracticable. Both of these fall within the compass of remarks, which will be found elsewhere made on the importance of a full development of native astrology.

It is entered in Des. Catal. vol. 1, p. 254, art. ii.

Manuscript book, No. 15—Countermark 908.

Section 1. Rules of observance in the *Onam* festival in Malayalam.

A general festival of four days corresponding with the *Dípali,* dated from *Maha Bali,* and the circumstances of the *Vámana avatára,* said to have been transacted in the Malayalam country. During this festival, bathing, putting on new cloths, looking at spectacles, or joining processions, are the matters detailed; referring to manners and customs, but also shewing how carelessly *Hindu* fiction deals with distant times and places.

Section 2. List of books in the library of the Travancore *raja.*

A catalogue amounting to 181 books is given, the titles, being written both in Telugu, and Tamil, characters. Sections 3 to 5, relate to district productions in Travancore, and to revenue details: a considerable portion of the book is occupied with mere tabular lists, which might have been of statistical value to a District Collector at the time.

Other sections from 6 to 18, inclusive may be seen specified in the Descriptive Catalogue, vol. 2, page 108; but, in the book itself, they are now in confused arrangement, sometimes are mere memoranda; and, in other cases are rough translations from the Malayalam. On looking over the whole, it is found, that the contents (where of any value), are anticipated by abstracts of Malayalam papers, and, for the rest, the matter appears to require no further attention. The book would need restoration, did the contents merit it: which I judge not to be the case; and therefore pass it as it is.

B.—TELUGU.

a. Palm leaf manuscripts.

1. *Varáha-puránam*, No. 103—Countermark 290.

The subject of this work was translated from Sanscrit into Telugu verse of the kind termed *Padya-cávyam* by *Singhaiya cavi*, son of *Gauda nayak*, in the time of *Narusimha-raja*, son of *Timma raja*, whose genealogy is prefixed; whence it is deducible that he was the poet's patron.

The following is a brief notice of the contents.

1. *Adhyáya*, or section. *Adi varáha* (or *Vishnu*), at the request of *Bhumi devi* (the earth personified) narrates the creation, the formation of the elements, the formation of solids and fluids, the origin of *Brahma* and other gods, and states various matters relative to *Casyapa*, *Atri*, *Náreda*, and other rishis; also concerning *Indra*, and the regents of the eight points (of the compass), and the various genera of living beings: these matters are stated in some detail. During the *Manwantira* of *Chacshusha Manu*, a king named *Parivriddha-rayen*, divided his kingdom among his sons, and became an ascetic in the *Naimisáranya* wilderness.

Section 2. *Raibyan* a king became desirous of acquiring mystical knowledge; relinquished his kingdom; and went to the same wilderness as an ascetic.

Section 3. His grand son, named *Sudhyumna*, acquired great power and fame; and, among other exploits, went to the world of *Indra*, giving an occasion to describe the *apsaras*, and other attendants of *Indra's* court.

Section 4. *Indra* being conquered by the said *Sudhyumna*, went to the presence of *Vishnu*, who protected him in his celestial kingdom. Further occasion is taken by the poet to describe the world of *Indra*; its buildings, shrines, attendants; their magnificence, ornaments, and the like; the model being the metropolis, and court, of a *Hindu* king.

Section 5. This portion of the work is entirely occupied with the narrative of *Dacsha's* sacrifice; the origin of *Vira Bhadra*, from the

anger of *Siva*, and other matters; which, having been heretofore given from the *Bhágavata*, need not here to be repeated.

Section 6. Mentions the transmigration of *Dacsha's* daughter, and wife of *Siva* after death; when she became the daughter of *Himala*, or *Parvata-rayen;* and, after a long penance by *Siva*, was again married to him as *Parvati.*

Section 7. Contains details concerning the four *yugas*, and the progressive degeneracy of mankind, from virtue to depravity.

Section 8. The ten *avatáras* of *Vishnu* are described. Further an account is given of the materials, from gold and silver downwards, proper to be made use of in forming images, or symbols, of those incarnations. Those persons who present offerings to such shrines, and who feed and clothe the *Brahmans*, have their beatification assured.

Section 9. *Vishnu* repeats the instructions which were given by *Durvasa-rishi* to *Bhadrásura*, a king. They relate to ceremonials on certain days; especially the *Ecádasi*, or eleventh day of each lunar fortnight, and dilate on the merit of gifts, and offerings, to *Brahmans;* which, in effect, is the substance of the said instructions.

Section 10. Mankind enjoying great plenty, and many persons having acquired wisdom, or initiation into mystical knowledge, the jealousy of *Indra* was thereby excited, so that he went to the presence of *Vishnu* and complained. *Vishnu*, after some reflection, determined on the introduction of various irregular systems of doctrine; such as the *Jainas*, *Páshandas*, and *Bauddhas*. It was effected by means of certain Brahmans going to the presence of *Gautama rishi*, without being attentive to the usual courtesies, and the reverence becoming to be paid. In consequence he denounced on them the doom of going back to earth; full of intellectual skill, but destitute of right knowledge, and a good state of mind. These persons, under the said perverted bias, introduced the perversions of the aforesaid systems.

Section 11. Concerning *Maheshásura*. This person acquired great power: so that he conquered on all sides, and none could resist th[e]... but fled away. An appeal was consequently made to *Pará-Sacti;* wh[o]... as *Durga*, encountered the said *Mahéshásura;* and, at length, killed...

him with an arrow. The incidents of this combat are given in some detail.

Section 12. Relates to modes of initiation into the *Saiva* and *Vaishnava*, systems of credence. The benefits of reading this *Purána* are stated, and respectful mention is made of *Vyasa*, through whom, instrumentally, all the *puránas* were declared to mankind.

Note.—This manuscript is a little old in appearance; two or three leaves, towards the conclusion, are damaged, by being broken: the book is otherwise complete, and in good preservation.

—It is entered in the Des. Catal. vol. I, p. 273, art. xvii; and is stated to contain "a translation of the entire *Varáha Purana*." The contents appear to agree with the summary of contents of the *Varáha Purana* given from a Sanscrit copy, vol. I. p. 45, art. xi.

Remark.—The use of this *Purána* in illustrating mythology is considerable. In so far as historical enquiries are concerned the most remarkable sections are 10 and 11. The latter, in particular, very clearly relates to the great exterminating war made against the votaries of *Buddha*. The combat of *Durga* against *Maheshásura* has been, by some, ridiculously termed the combat of personified virtue, against personified vice. No doubt there is personification, and mystic allegory; but not precisely to that said effect. There are several great wars indicated in *Hindu* story; some of them under a similar mystic veil; as:

1st. That of *Subrahmanya* against the *Asuras*.

2d. That of *Parásu Ráma* against the *Cshetriyas*.

3d. That of *Ráma* against *Rávana*, and other *Rácshasas*.

4th. That of *Durga* against *Maheshásura*.

And *Maheshasura*, in my opinion, is very propably only another name for the mysterious personage more usually in the south denominated *Sáliváhana*.

The clue of symbolical writing which I have been enabled to get hold of in the course of these enquiries, will, I am persuaded, if patiently, and perseveringly followed out, by individuals more capable in the earlier languages than myself, ultimately tend to solve much of the marvellous, and paradoxical, contained in *Hindu* writings; and draw aside, at least a part of, the cloudy veil which now, like a fog of great density, hangs over, and obscures, our view of remote antiquity.

2. *Vencatesvara Mahátmyam*, the legend of the fane at Tripetty, No 102.

This is a manuscript of two hundred and two palm leaves, a little old; but in good preservation, and in fine hand-writing. It is the production

of *Srinivasi* otherwise called *Srinát'ha* or *Vencataraiya;* who was patronized by *Anavema reddi* of *Condariti.* It is in the *dvi-pada* measure; and relates wholly to the various shrines, *tir'thas* (or pools), and other localities, deemed sacred, on the *Vencatáchala* hill, at Tripetty; considered simply as a *Vaishnava* fane, without any reference to its former character, as a *Saiva* fane, antecedent to *Rámanújácharya.* Of course the entire production is comparatively modern; and consistent with the era of *Srinivasi.*

It is entered in Des. Catal. vol. I, p. 274, art. xviii. together with a valuable notice of the shrine at Tripetty; not entirely deduced from this legend, but with additions from other sources. It is to be noted, that though *Tondimán Chacraverti,* the first founder is said to have lived in the beginning of the *Cali* age; yet, from many sources of deductions, we can prove him to have flourished at a much later period. For the rest, the place owes its distinction to its being near the capital of the *Yádava,* and the *Chandragiri,* kingdoms.

3. *Mantra sárárt'ha dipika,* the concentrated light of devotional formularies, No. 119—Countermark, wanting.

This is a work of an ultra *Vaishnava* kind, maintaining all things to be in *Vishnu,* and *Vishnu* to be all things. It contains also an outline of various formularies, according to the different votaries of *Ráma, Crishna,* and other impersonations of *Vishnu.* Men, animals, and inanimate things, are only forms, or manifestations, of portions of *Vishnu.* The *tatva* system, relative to the union and harmony of mental and corporeal faculties, and results produced thereby, is found among the other matter. The rise, celebrity, and death, of *Rámanújácharya,* the champion of this ultra *Vaishnava* system, is given. Mention is made of some shrines of *Vishnu,* but subordinated to the leading doctrine of the work, as to his all-pervading, and all-absorbing essence. It would indeed be a work strictly monotheistical, were it not for the admission of local shrines, multiplied *avatáras,* and the pantheistic idea of matter being the body or clothing, of a pervading soul.

The manuscript is complete, and in very good preservation. I should suppose it to be valuable, as a work explanatory of the system of *Ramanuja,* and his followers; which is one of great influence, and credit, in various parts of the peninsula.

Note.—It is entered with a brief, but accurate, indication of the contents in Des. Catal. vol. 1, p. 349, art. 372.

4. *Hamsa vinsati,* or twenty (tales) of a swan, No. 77—Countermark, wanting.

This book contains a poem in five *asvásas,* or sections, written by *Naráyana,* in the *Pádya Cavya* measure. The introduction of the series of tales relates to a king of Ougein, who had all the excellencies of *Harischandra,* and other famous monarchs; to whom a *yogi,* or ascetic, was introduced. This ascetic was a great traveller, having visited Bellary, Madras, and many other places; on which account the king deferred to his superior judgment as to the surpassing attractions of a lady of whom he was enamoured. After some time the king was absent from his spouse, who was inconsolable. But a bird (*hamsa*) of the genus *anser,* narrated a variety of tales, in order to amuse her, to divert her attention, and to console her with hopes of his return. The author pays his respects, in the usual form, to *Allasani Peddana, Tikana-Somayáji,* and other distinguished poets; from which circumstance, and the mention of modern towns, the work may be considered of recent composition; and, except perhaps as a poem, it is of no value. It is complete, and in good preservation. Part of the leaves are very recent; part somewhat older.

It is entered in Des. Cat. vol. 1, p. 325, art. xxii.

5. *Narayana-dyāna-padyalu,* verses on the meditation of *Vishnu,* No. 107—Countermark 384.

This is a fragment of a manuscript, a little old in its appearance; written in the *dvi-pada* metre; and containing stanzas of hymnology, in praise of *Naráyana.*

It is complete from the first to the ninth leaf: the remainder is wanting.

The above title is taken from the Telugu; the label in English having been worn off. I do not know where to find the entry in the Des. Cat. It is not found under the above title.

6. *Vicramarca Charitra,* or tale of *Vicramáditya,* No. 64—Countermark 463.

Same title No. 65—Countermark 464.

These books contain the tale concerning *Vicramáditya,* and his attendant *Vetala,* or familiar demon; popularly well known; and needing here no abstract, No. 64, is old; in regular order, as to the paging from p. 1, to 165; but it is considerably damaged; not so much from internal perforation of the book-insect, in the ordinary way, as from the eating away of portions of the edges: the work externally as it seems, of termites. It contains thirty-two stories complete. At the beginning the narration of them is ascribed to *Siva* as told to *Parvati.*

No. 15, is recent, in a neat hand-writing; slightly punctured, and innured within, by insects; for the rest in good preservation. It contains only two of the tales complete.

Note.—These manuscripts are entered in the Des. Cat. vol. I, p. 343 art. lxvi.

7. *Vedanta rasáyanam*, the substance or essence of the *Vedanta*, No. 120—Countermark 472.

This is a rather singular work to meet with, in this collection; conveying an emotion of pleasurable surprise. It is the production of a Telugu Brahman, by birth; but of one who had become a Christian, by profession; and is written both to explain, and to advocate, the Christian religion. The author had studied the *Vedanta* system of *Vyasa* and his followers; and, as that is the substance of the *Vedas*, so in this book he gives the substance, or essence of the Holy Scriptures, especially of the New Testament. Various portions of the contents of both the Old and New Testament, are adverted to, or narrated; and the superiority of the Christian religion is enforced. The *Bháratam*, *Bhágavatam*, and *Scandam*, are adverted to by way of contrast, and confutation; and idolatry is strongly condemned. The term *Sarvésvara* (common among Roman Catholics) is employed to designate the Supreme Being; whose unity, as opposed to polytheism, is maintained. The names of some Patriarchs are mentioned, and compared with the name of *munis*, such as *Vasishta*, *Visvamitra*, and others, familiar to Hindus. A recommendation of the Christian religion; the necessity of baptism; and the great blessings of deliverance from the power of evil; are other portions of the contents. The author gives his name as *Anandábhi*, son of *Timmaya* of *Mangala giri*, of the *Atrasa-gótra*, or family. As *Anandàbhi* is the same, in effect, with *Ananda rao* or *Ananda-rayer*, I am enabled to recognize the author as being the same with *Ananda-rayer*, a Brahman, of whom at different times I have heard, and read, something; but with whose entire biography I am not acquainted. From a gentleman, who personally knew him, I have learned that he was accustomed to make use of some such work as this, in daily conversations, and discussions, with *Brahmans* and others. I was further glad to hear, that this gentleman regarded him as a sincere, though in some respects, an imperfect, Christian. He was in the employ of the Reverend Messrs. Cran, and Desgranges, of Vizagapatam; and, as I conjecture, composed this book at the suggestion of one, or both of them. It is written in the *Padya-cávyam* measure: and divided into four *adhyáyas*, or sections. The seventh, eighth, ninth, and tenth,

palm leaves are wanting; all besides is in regular order; and the manuscript is in very good preservation.

NOTE.—It is entered, with a general indication as to the contents, in the Des. Catal. vol. 1, p. 349, art. 73.

8. *Rama raju vijayam,* the triumph of *Ráma raju*, No. 43—Countermark 309.

This book, otherwise entitled *Narapati vijayam*, is an encomiastic poem on *Ráma ráju*, the son-in law of *Crishna rayer ;* who was, at first, the minister of *Sada Siva*, and, at length, usurped the sovereignty; but was afterwards killed in battle against the Mahomedans at *Talicotta.* It is, by one authority, ascribed to *Timma-raj*, one of the eight poets of *Crishna-rayer's* court; on which point I am doubtful. The subject is, at the outset, a genealogy, deduced from the usual *Chandra vamsa*, or line of *Hastinapuri :* after the close of that race, it branches off into what is termed the *Sinhu-culam*, or lion tribe. It comes down, through the *Chalukiya* race, to *Ráma-raju* himself; and thence forward is extravagant in its panegyric. It must be observed, that the genealogical list is very lengthy; as including the whole of the lunar line, in the most ancient portion; and quite as many names in the more modern series. How far the author had the means of access to records, subsequent to the cessation of the *Chandra-vamsa*, I cannot tell; but it is in that portion that the list would merit to be compared with the various other documents contained in this collection. It seems worthy of remark, that, while western, and southern, Peninsular records always mention *Vicramáditya*, *Sáliváhana*, and *Bhoja raja*, the records of the upper and eastern portion of Telingana usually continue the lunar line by transfer to the *Chalukiyas ;* and a careful attention to this distinction may ultimately enlighten all that is obscure in the early centuries subsequent to the commencement of the Christian era.

NOTE.—The manuscript is old; written in a very small hand-writing; but remains without material injury. Some other work seems to have preceded it, as the No. on the leaves commences with 50: it is regular thence down to 75, where the writing leaves off, without having been finished (as supposed) by the copyist.

It is entered in Des. Catal. vol. 1, p. 297, art. ii. with the later portion of the genealogy, immediately preceding *Rama raju.*

b. MANUSCRIPT BOOKS.

1. Manuscript book, No. 18—Countermark 310, *Narapati-vijayam*, or *Rama raju vijayam.*

Narapati, is merely the titular appellation of the kings of *Vijayanagarum.* In a blank leaf is an entry in the hand-writing of Colonel Mackenzie, "Naraputty Vijaem, copied from the raja of Anagoondy's manuscript 1800." It is the same poem as the preceding: but is also incomplete. The ink is a little pale; the paper good; the first leaf loose: but, for the rest, in good order; and does not require further notice.

It is entered in Des. Catal. as above.

2. Manuscript book, No. 13—Countermark 810.

Section 1. Account of agricultural, and other details of twenty-nine villages, in the *Chinta-kunda* district.

The details are of minor interest, and do not call for particular notice. The district lies, I believe, a little to the north of Cuddapah.

Section 2. Account of the zemindari of *Mallala Samustanakula.*

In this section the details chiefly relate to matters of revenue; accounts of the *carnams;* and the like: of no material consequence.

Remark.—The book is in tolerably good preservation. The back is loose, and a few of the leaves slightly touched by insects, yet not calling for restoration, even were the contents of consequence; inasmuch as the ink is indelible; and the whole can be everywhere read with the greatest facility. It should, however, be looked at occasionally, in order to prevent further damage, from worms or insects.

Manuscript book, No. 16—Countermark 813.

This volume, having reference to the Ceded Districts, contains local details relative to forty villages, and seven *agrahárams,* or brahmanical alms houses. It is a small quarto; and of course, with so wide a compass, the details are brief. They consist chiefly of notices of fanes, and of donations to them. A few dates of inscriptions are mingled; according to specimens already repeatedly given. Hence minute abstract does not seem to be required; especially as the book is written with permanent ink, is only very slightly touched by worms, and otherwise in perfect preservation.

Manuscript book, No. 5—Countermark 635.

Ancient record, containing the geography, and chronology, notice of *Carnams,* and limits of districts, of a part of *Telingana.*

The contents of this book run on in consecutive order, without break,

or division. For the sake of perspecuity, a brief index may be numbered.

1. A definition of the limits of the country, called *Condaviti*, with the boundaries on four sides; and a specification of its most remarkable features, as to rivers, hills, fanes, towns, reservoirs, and the like matters.

2. Names of kings or rulers, in the *Dwápara-yuga*. The *Chandra-Vamsa*, with *Vicramaditya*, and some other rulers, specified.

3. From *Salivahana* down to the *Mukundi* king *Pratapa-Rudra*.

4. A few names of the *Asvapati* race (in this place not designating Mahomedans); followed by mention of the *Gajapati*, or Orissa, rulers; and of the *Narapati*, or *rayers* of *Vijayanagaram*.

5. The *Ganapatis*, and the *Reddis*; with the specification of the periods of their rule over the Warankal country.

6. From *Crishna-rayer*, down to the Mahomedan conquest of his dynasty: dates, and details, are given.

7. A specification of village-districts, and villages, or hamlets, included within them, as comprised in the *Condaviti* principality, follows. This principality was under the rule of *Pratápa-Rudra*.

8. Detail of the *Gajapati* rulers, with their chief ministers, and the influence exercised by them over the *Condaviti* principality.

Mention of twelve different subdivisions of *Carnams*, or *Niyogi* Brahmans, who obtained grants of lands with *mirási* rights, and other immunities, inclusive of *agrahárams*, received from *Gajapati*, rulers, from *Pratápa Rudra*, or from the *Reddis*, during their rule; illustrating the colonization of the country by the secular Brahmans.

9. Details of grants, or privileges, bestowed by *Asvapatis*; who ruled on the north of the river *Crishna*.

10. Some mention of the rule of the *Narapati* princes, over the district; chiefly with reference to the grants and donations made by them.

11. Similar specification with reference to the grants made by the *Gajapati* rulers, during the period of their power.

12. Specific mention of grants made to particular Brahmans, by the *Reddis*, exclusive of more general ones, before adverted to.

13. The like specific mention of donatives to particular Brahmans from *Crishna Rayer*.

14. Reference to a particular *pergannah*, or country, having 11 included districts; which received immunities from the *Gajapatis*.

15. Donatives, to the same locality, from the *Asvapatis*, and from *Sadá-Siva Rayer*.

16. The usurpation of the entire country, by the Mahomedans;

their raising the taxation: renting out to Hindu managers, and other proceedings; close the document.

General Remark.—In the midst of much unimportant matter, there are historical materials scattered through this book, of some value The construction of the social system naturally gives a tincture to Hindu records. As with them, Brahmans, however needy, are higher in rank than princes, next to gods and even "gods on earth;" and since donatives to them are the highest possible act of virtue, or munificence; it will follow that historical records, especially when written by Brahmans, seem to notice princes, or rulers, only according to their munificence to fanes, shrines, and sacerdotal, or secular, Brahmans, with their eleemosynary dwellings. Hence the history of peninsular India, subsequent to the general influx of Brahmans, secondarily from upper Hindustan, and primarily from some as yet unknown region, usually is what may be termed hierarchical, since the epithet ecclesiastical cannot with accuracy be applied to it. With our different notions, allowance must be made for the structure of society in India; and, in re-edifying the materials, we ought not to despise them, as in some cases has been hastily done, because they are not formed after the Greek, or Roman, or Gothic, fashion. For the rest, we can shape them as we please, to make them fit into our building, subject to this remark. I think the materials in this book might merit a being brought out in full detail.

Note.—The hand-writing being small, and the country paper severely injured, by worms or insects, I have had the entire document restored.

C.—CANARESE.

a. Palm leaf manuscript.

1. *Sancara-Cadha,* account of *Sancara,* No. 75—Countermark 529.

This manuscript consists of two portions: the first relating to *Sancarácharya,* and the other to *Madhvácharya,* the founder of *Vidyanagaram* or *Vijayanagarum.*

1. The biography of *Sancara,* narrates his birth, in the Malayalam country; his peril in crossing a river, and devoting himself, by a vow to an ascetic life. He afterwards travelled to various places; and encountered a variety of marvellous adventures, needless to be detailed. At a more advanced period of life, he founded the monasterium of *Srin-*

geri. He was the champion of the *Advita* doctrine, that there is no distinction between God, and the human soul; and, as opposed to *Ramanujácharya*, maintained the perfect equality, and essential unity, of *Siva* and *Vishnu.* He is head of the *Smarta* sect, who profess to follow the *Smritis*, or law systems. There is no Hindu teacher whose opinions, and instruction, have had a wider influence than his; especially in the peninsula.

2. The other part relates to *Vidyáranya*, the founder of *Vijayanagarum.* He was the son of a Brahman; and was well instructed in the *Vedas*, and other learning. He performed penance, directed to *Devi*, for the acquisition of wealth: who appeared, and told him his request could not now be granted. He then travelled on pilgrimage; and, among other places, visited *Sringeri*, where he studied, and received thence the titular name of *Vidyáranya* or "forest of learning." He was purposing to visit *Vyasa*, in the north; and took with him a *rácshasa*, whom he met with near the *Vindhya* mountain. He went to *Cási*, and on coming back, passing through the *Tuluva* country, met with *Sangama-rayen*, who had five sons; among whom were *Hari-hara*, and *Bukha*; the former of whom by his advice and assistance was established as a king at *Vijayanagarum.* He again went to *Sringeri*, which shrine received munificent grants and privileges from *Hari-Hara-rayen*, and *Bukha rayen.* There are two dates given; one being Sal. Sac. 1265, as the period of the first visit to *Sringeri*, and 1258, as that of the foundation of the town of *Vijayanagarum*; they may be transposed, or seventy-eight may be read by conjecture for fifty-eight, or both may be fictitious. However *Vijayanagarum* was founded about that time.

Note.—This book is old; it is written on talipat leaves; and is in perfect preservation.

It is entered in Des. Catal. vol. 2, p. 35, art. xli. as "a short account of Sankarācharya."

2. *Nannaya-Charitra*, account of *Nannaya*, No. 69—Countermark 517.

This book in the *Hala kanada*, or old *Canarese*, relates to a teacher of repute of the *Vira Saiva* class, named *Nannaya*, not to be confounded with *Nannaya Bhatt*, a Telugu poet of eminence. This *Nannaya* was an ascetic, who had many scholars; one of whom took down the substance of his instructions, and recorded them in five books. The subject of these instructions turns very much on the fanciful *tatva* system, or the union, and results, of the corporeal, and mental, faculties. There are

also sectarial descriptions of *Siva ;* of his paradise ; and votaries. The language, I am told, is distinguishable from the ordinary phraseology of *Brahmans*; and it would seem as if *Basavapa*, head of the sect, was rather a warrior of the *Sudra* class, in which case *Nannaya*, and the scholars of the latter would be *Sudras* also. The system is ultra *saiva* ; it neglects or despises the *Vedas ;* and proceeds wholly on the *Tantras* or *Agamas*. There is, however, much that agrees with the more generally received system of *Hinduism*. While the *Vira Saívas* vary from other *Hindus*, they are the still more direct opponents of the *Jainas ;* and the extermination of the *Jainas*, in the N. W. of the Peninsula, was chiefly effected by them. They are usually termed *Lingadharis* in the neighbourhood of Madras.

Note.—This manuscript is in appearance very old ; it is complete. The leaves are in some places perforated by worms ; occasionally obliterating some letters ; though this injury is less than might have been anticipated. When first opened several small white worms were turned out of it, and these, in a month or two, would have rendered the whole illegible. A little care is necessary with these manuscripts, in occasionally opening, and drying them. It ought to be a special duty of some one individual.

The manuscript is entered in Des. Cat. vol. 2, p. 31, art. xxxii.

b. Manuscript Books.

Manuscript book, No. 5—no Countermark.

The contents of this document are partly in Mahratti, and partly in Canarese. The former has been before attended to (see 4th Report c).

The Canarese is now adverted to ; in order that the book may be finally disposed of.

Section 1. (In Mahratti). It has a page of Telugu, in Canarese letters, relating to a wonderful tree, looking large at a distance ; diminishing on approach ; and disappearing on coming very near. It can only be found by the wise, and spiritually enlightened.

Section 2. Relative to *Chandra-drona parvatam*, is partly in Mahratti, with a supplement in Canarese writing, not differently sectioned, but which supplement is properly, a legend of *Dattátreya*.

It is in the Canarese character ; but the language on examination was found to be Telugu. It relates to the sage *Dattátreya*, and his

matronly wife. Previous to retiring from his hermitage to a cave, for the purpose of entire abstraction from the world, he performed some *mantras* over a vessel of water, which he then gave to his wife; telling her to take care of their abode, while he was away; to entertain all good *rishi's*, or devout men, with cordial hospitality; but if at any time, she should be molested by vulgar, or rude persons, she might sprinkle over them a little of the water in the vessel, and accompany the doing so with whatever wish she might please, and the same would be accomplished. *Dattátreya* thereupon retired to his cave; and, after some time, his wife received a visit from some *rishis*, on their journey, claiming her hospitality. She placed food before them, of which they refused to partake, unless she would accompany her serving it up with a degrading mode of menial servitude. She reflected for a moment; and, then sprinkling over them a little water, wished that they might become children, and the transformation was instantly accomplished. She then put the infants into a cradle, attended on them, and nourished them as such. The *rishis* became missing; and the celestials went to *Parvati*, to enquire about them; who narrated what had happened. The celestials waited on the matron; and, at their desire, she sprinkled water on the children and, by a wish, restored them to their previous form. They were dismissed; and, after bathing, went their way. *Dattátreya*, soon after opened his eyes; and, leaving his abstract penance, came out of his cave: on learning what had happened, he became of opinion, that it was not right to expose his wife alone, and subsequently he took her with him to the cave, when he retired thither. On doing so, the four colours (or castes) came, and watched at the entry. At length unable to bear the heavy dew, and the cold, they went away. One *Budda Saheb*, a Mahomedan, hearing of the fame of the hermitage, waited there, and preserved it. After some time *Dattátreya*, came forth, and gave him some instructions; of what kind is not specified.

Section 3. Legendary account of *Battadapur* in the Mysore country.

This paper is in Canarese characters, but the language is a *Pracrit*, or corrupt Sanscrit. It relates to a fane of *Mallicarjuna*. There are three brief *adhyáyas*, or sections; and the contents, besides some legendary matter at the commencement, relative to a dispute between two *rishis*, has the usual filling up of *St'hala mahatmyas*, relative to shrines and pools. Eight *tirt'has* are mentioned: that, is those of *Agni*, *Mucti*, *Gauri*, *Ganga*, *Rama*, *Airávata*, *Dacsha*, *Hanuman;* with details of merit, and benefit, of bathing therein. In the second section

the narrative is given of several persons of high repute, who worshipped at this fane; thereby reflecting lustre upon it. The third section has a special reference to *Arjuna;* to his penance at this place, and connected matters; whence it would appear, that the name of *Mallicarjuna*, as applied to the idol, was derived. The legend is put into the mouth of *Náreda* as related by him to *Gargara rishi.*

Section 4. Account of the *Gautama-agrahâram*, in the *Anantapur* district of *Bidanur.*

The legend, in the Canarese language, is carried up to the time of *Janamejaya,* who visited this place; and, as his father *Paricshit* died by the bite of a serpent, consequent to offending a *rishi,* he, the son, had a serpent sacrifice performed on the banks of the *Tungabhadra* river: he then made large benefactions to this place; and in the *agrahâram,* located various orders of Brahmans, who are specified by their *gótra,* or tribe, subsequently in the time of *Ballála-rayen* and the *Anagundi* rulers, the said privileges were continued. A local chief, the Mahomedans, the Peishwa, and others, are mentioned, as variously deporting themselves towards the shrine. Tippoo abrogated its privileges; but after the English had given over the country to the Mysore prince, its privileges were partially restored. A list of fanes, and of the names of eighteen head Brahmans, of different tribes, is added to the document. These, it may be observed, are expressly spoken of as introduced from the north. The name of each *pattar,* or head Brahman, need not be specified: occasionally two, or more, of these are of the same class; but the *gotras* mentioned are *Casypa, Agastya, Srivatsa, Gautama, Vasishta, Cavundanya, Bharadhvaja, Haridasa, Jamadagni.* The place took its name because *Gautama* (or his tribe), first established an emblem of *Siva* there.

Section 5. Account of *Halli-honùr* in the same district.

At this place *Ballala rayen,* of the *Ballala* race, was cured of leprosy by bathing. In consequence, though himself a *Jaina,* he formed a high estimate of this shrine, at which he built a fane, and made various grants to Brahmans. He built an *agrâharam* for them, termed *Halli Honúr* (Honore), and also constructed a small fort there. He ruled thirty years. His son was *Yarayanga-rayen,* who ruled forty-one years. His son was *Vishnu-Verddhana-rayen,* who ruled fifty years. His son *Vijaya Narasimha rayen* ruled twenty-three years; *Vira-Ballála-rayen,* son of the preceding, ruled forty-five years. In his time one named *Ganga sila-rayen,* in the service of the Delhi Padshah, came,

assaulted, plundered, and destroyed; and then went away. The son of *Vira Ballala-rayen*, was *Vira-Narasimha Ballala rayen*, who ruled sixteen years. His wife's son, named *Vira-somesvaren* ruled nineteen years. His son was *Vira-Narasimha Ballala-rayen*, who reigned forty-six years. In all there were nine of this race. The last of them *Ballala rayen*, is represented to have been a dissolute, and cruel person; and among other misdeeds, hung his elder sister, at the instigation of his wife. Thereupon his whole family became deeply afflicted, and imprecated upon him the loss of his kingdom. The Delhi-Padshah heard of these things; and gave his permission to the two brothers, named *Hari-hara rayen*, and *Bukha-rayen*, to make war upon *Ballala rayen*. They did so, for some time, without success; but at length obtaining the favour, and assistance of the sage *Vidyáranya*, they succeeded in overthrowing the power of *Ballala-rayen*, and upon the ruins of it founded the town of *Vijayanagarum* (in Sal. Sac. 1258), and its connected kingdom; of which *Hari Hara* was made the first king.

The names of thirteen of his successors are given, down to Sal. Sac. 1412 as follows:

	Years.
Hari-hara rayen	14
Bukha-rayen	31
Hari-hara-rayen	29
Vira-deva-rayen	17
Pravuda-Bukha rayen	16
Mallicarjuna-rayen	17
Runghana-Rama rayen	9
Singhana Vijaya Virupacsha rayen	10
Pravuda deva rayen	16
Virupacsha-rayen	4
Deva-rayen	6
Rama-rayen	13
Virupacsha-rayen	22

The total it is said makes one hundred and fifty-five years, which would agree with the interval between the two dates given, but the real total is two hundred and four; leaving the inference open that precise accuracy is not contained in the number of years ascribed to each ruler. Besides which some of the numbers, where double, are doubtful; as they may imply, and probably do in some cases imply, years and months. The total of one hundred and fifty-five is the right one to be followed, with an adjustment of the years of each king.

From Sal. Sac. 1412, down to 1486, eight persons ruled, as follows :

	Years.
Pravuda deva rayen, son of Pravuda Singha rayen..	5
Vira Narasimha rayen	2
Narasimha rayen	12
Crishna rayen	16
Sada Siva rayen	5
Achyuta rayen	12
Timmaiya	8
Rama rayen, in the name of Sada Siva rayen......	22

In this statement there is a discrepancy of eight years. During the government of *Rama rayen*, in the name of *Sada Siva rayen*, one named *Chickadeva rayen* received the fort of *Halli honùr*, and with it a country producing a revenue of nine lakhs, from *Rama rayen*, as a fief. After *Chickadeva*, one named *Sada Siva nayak* ruled four years. His son was *Santana nayak*. A list of successors, as local chieftains, or feudal barons of *Honùr*, follows ; but the document at the end remains unfinished.

Section 6. Account of *Uduguni* in the same district.

The origin, in a legendary manner, is carried up to the time of the five *Pándavas*. The *Cadamba* dynasty afterwards ruled over this place. Of the *Rayer* dynasty, *Deva rayen* especially distinguished this place. In a discussion with the people of the country, occasion arose of approaching the foot of a tree where there was a large ant-hill, out of which a large guana lizard issued; fell upon the attendants of the local chief; and bit them severely. From this it was inferred that something special was connected with this ant-hill; and on digging it up, an image of *Hanuman* and of *Sala devi* were found. A fane was built for these images, especially for *Sala devi*, and from her name the word *Uduguni* is said to be derived. It is added that the *Cadamba* dynasty, ruled down to Sal. Sac. 1025. For a time it was not under any king. Afterwards the *Rayer* dynasty is adverted to, but, in both cases, only with a reference to matters connected with the shrine of *Sala devi*. A sássanam remains, whence it appears that in Sal. Sac. 1291, *Bukha rayen*, gave to the fane the two villages of *Muchari* and *Mudali*.

In Sal. Sac. 1416 the Padshah of Bijapur, captured the place, and gave it in charge to *Vira navadiyar*. The Seringapatam rulers acquired, at a later time, the sovereignty; and, at still later times, it was under the management of amildars.

Sections 8, and 9, in Mahratti, have been before noticed.

The Canarese papers in this book, with the exception of the paper concerning the fane of *Mallicarjuna*, are in a bad state as to preservation. The only sections of permanent value are four, and five. The entire contents of this book, No 5—Countermark 871, have now been abstracted.

Manuscript book, No. 4—Countermark 649.

This book contains a fragment, being the earlier portion of the *Panchatantra cadha*, or tale of the " five devices," a highly popular work, found in every language of India. In this copy the Mahratti characters are employed; but the language is Canarese. The paper is somewhat damaged by insects; but the writing perfectly legible. Being only a fragment, and that too of a very common, and popular work, restoration does not appear to be required.

Manuscript book, No. 7—Countermark 873.

This is a thin folio volume, in perfect condition ; being written with indelible ink, on thick Europe paper, not even touched by insects. The writing is in Mahratta characters, but the language is Canarese. The contents are the revenue settlement of the *Rayalu*, or rulers of the country, for the district of *Dankeni cotta;* being, of course, details not requiring abstract in the present enquiry.

Manuscript book, No. 20—Countermark 866.

This is a similar book to the preceding ; containing the same document in the Canarese characters, and language ; the ink being a little faded. There is appended a comparatively brief paper entitled, *Rai-raka*, or settlement of the rulers, and relating to the district of *Hona-halli*, copied from an original record on a *Cadattam*, or painted-cloth folded. The ink in this latter copy is good ; and the paper throughout in perfect preservation.

Manuscript book, No. 1—Countermark 887.

Section 1. List of ancient *rajas* procured in the *Sunda* district.

Certain kings of *Mágadha.* The *Cadamba* dynasty. *Trinetra Cadamba-rayen* was the first of them, who ruled forty-five years. His son *Mádhu* reigned fifty years: some other successions down to *Mayura verma.* His son was *Trinetra Cadamban.* The successions are continued down to an invasion by a *Concana* king, of the *Parpara* dynasty. Kings of this race follow, twenty-one in number. *Vira Camadeva-rayen* conquered the last of that dynasty. The *Ballala* dynasty. Their capital was *Dwára Samudram.* They are the *Oyisalas;* nine in number. *Hari-hara rayen* overcame them; and ruled in *Vidyanagaram.* The line of the *Rayers* is referred to, as having been before transmitted. Their becoming enfeebled, and ruling at *Annacondai,* is simply mentioned. The rule of some *Nayaks* or local chiefs, as supposed in the *Sunda* district, is stated. The *Chola* dynasty: some of the names are the same as in other lists, others are different; but we know that these kings had two or three titular names. A reference to *Ballalas,* who ruled in distant, and distinct, places; apparently without successor: one at *Trinomali.* A list of *Andhra* kings; town not specified. Loose mention of *Warankal,* and other, rulers. There is then a reference back to the *Saovirashta-désam,* and other countries, unconnected in form. *Molli raja,* is said to have ruled at *Ballaki-patnam* in the Bengal country; and *Bhoja raja* is said to have been his son. One or two *Udriya* kings are mentioned; and then a leap is made down to Madura: the name of *Sundara-Pandiyan,* occurs, with a transit immediately afterwards to the *Kerala raja.* After other scattered notices of individuals, a return is made northwards to Ougein, and *Vicramáditya.* Then a reference to Delhi. A return back to Madura, and to *Kuna Pandiyan.*

Note.—The only value of this paper is with reference to the *Cadamba* line, and succeeding races down to the conquest by *Hari-hara rayer.* All the rest is incoherent; both as to times and places, and mere names, such as a person might casually hear mentioned in conversation, as of those once ruling in India. There are no dates either of the *Cali Yuga,* or any other era. The ink and paper are in sufficiently good preservation to allow of reference to the first part, many years hence; if need be.

Section 2. Account of wild tribes in *Sunda* and *Çanara.*

Nothing answering to this heading appears; and there are marks in the book of several sheets having been torn out, or otherwise lost.

Section 3. Account of the *Coramaru,* in the *Sunda* country.

There are four classes among them, some of their household, or domestic, customs are stated. Marriage settlements, and observances, mode of receiving proselytes into their class. They have no Brahmans amongst them. Many of them live professionally by theft. They are scattered; some in villages, some in wilds, or forests.

Section 4. Account of the *Cunumbi Mahrattas.*

The *Surya* race deduced from *Brahma,* down to *Vaivasvatu-menu;* and then a reference to *Paricshit,* and *Nanda;* from whom various races sprung by intermarriages. Hence the *Cunumbis* deduce their lineage; they are scattered in various countries; both in the north, and in the peninsula.

Section 5. Account of the *Banijagar* tribe of Telugu people.

Their household customs. Fourteen minor subdivisions among them specified. Their marriages. Mode of correcting offenders, and some other details; of no consequence.

Section 6. Account of the *Cudi Cumbhar*, or tribe of potters.

Various local usages, and customs. Marriages are only contracted by adults. They sometimes burn, and sometimes bury, their dead. They do not admit of proselytes from among other classes of people. These with minor details, form the subjects of this paper.

Section 7. Account of the *Gangadicar,* or gardeners in *Sunda.*

Their domestic, marriage, and other local, or peculiar, customs, are stated; but there does not seem any thing needing special note. In many points their customs have an affinity with those of the potter-tribe.

Section 8. Account of the tribe of *Manvettiyar,* or diggers of water reservoirs.

They have minor distinctions among themselves; and their customs are stated. They dig wells, reservoirs, channels for irrigation, &c., being, like the two preceding classes, very useful, though servile; and are apparently derived not from colonist *Hindus,* but from aborigines of the country.

General Remark.—Though the papers in this volume are in some degree curious, as to local tribes and manners, and the first of some little historical value, yet they do not seem to claim restoration, especially as the ink is tolerably good, and the paper, though very inferior, only in a slight degree damaged by insects.

Manuscript book, No. 2—Countermark 888.

Section 1. Legend of the fane at *Banavassi*, in the *Sunda* district.

Reference to seven *upa-puris*, or second rate towns (in regard to mythology) formed by *Brahma*. Among the seven was *Banavassi*. It had different names in different *yugas*. Legendary matter as to *Saiva* emblems follows. The kings in the *Cali yuga* beginning with *Parieshit* are adverted to. Several names that follow are those of *Mágadha*, down to *Nanda;* and a division of country among his nine sons. *Chandra gupta*, and nine of his descendants. *Pushpamitra* set the last of the nine aside; and assumed the sovereignty.

Remark.—Hence it appears that the only proper reference to *Banavassi* is legendary, and mythological. What is stated about kings all relates to *Mágadha*, or modern *Behar*.

Section 2. Account of the *Chennaiya culam*, the lowest tribe in the *Sunda* district.

Domestic, and marriage, customs. The paper is very similar to like statements in the foregoing book; and offers nothing worthy of special notice.

Section 3. Legend of the fane of *Sirisi*. Notice of two *Saiva* emblems. A fane of *Ganesa*, another of *Mariyammen;* to the last of which, a grant of lands was made; and it now receives an allowance from the Honourable Company. In another shrine there is an inscription dated Sal. Sac. 915, but its contents are not stated. Mention of a fort near at hand. A few other details follow, offering no special point of interest.

Section 4. Account of the *Concani* tribe in *Sunda*.

Reference to the formation of the *Gauda* and *Dravida Brahmans*, by *Brahma*. The narration of *Parasu-rama*, his destruction of the *Cshetriyas*, and gift of the country to *Casiyapa*. He then went to the *Malayala*, or *Kerala*, country, and introduced the *Brahmans* thither; the *Concanis* being among the number. The like account is referred to, in the paper, as being contained in the *Scanda-puranam*..

Section 5. Account of the *Cunchi vakkala* tribe in *Sunda*.

There are minor subdivisions among them; and their domestic, and marriage, customs are stated.

Section 6. Account of the *Melusacara* tribe in *Sunda.*

Some minor subdivisions. Their customs, and observances, are more Hindu-like, than those of other tribes before noted. The statement is however very concise.

Section 7. Account of the *Medari* tribe.

A brief reference to their customs, which resemble those of *Hindus.* The tribe has four subdivisions.

Section 8. Account of the *Padma-sali,* or weavers.

Eight subdivisions. Local manners; offering nothing, requiring special remark.

Section 9. Account of the *Hallapaica* tribe, or wild people in *Sunda.*

Domestic, and marriage, customs; with other details, under similar heads, as in preceding cases. There appears to be a mingling of aboriginal, and of Hindu, customs. Most of the tribes that have been described afford traces of resemblance to the *Condu-vándlu, Nayars* and *Maravas.*

Section 10. Account extracted from the *St'hala mahatmya* of *Banavassi* in *Sunda.*

The writer saw the whole legend in the old Canarese language. A special circumstance was by him extracted. To wit: *Mayura verma* established in his capital a *Brahman,* who had impressed him with reverence, by refusing to eat in a country wherein there were no *Brahmans. Chandrangaten,* son of *Mayura verma,* called a large colony of *Brahmans;* and located them in *Kerala,* in *Tuluva, Haigairi, Concana, Carada.* The first speak the Malayalam language; the second the *Tuluva* dialect, the third *Hala canada*; the two others different dialects of *Maharashtram. Parasu Rama* afterwards came to this country, bringing with him a colony of sixty four families, among whom he established his own *vaidíca,* (ascetical*) system; but between these, and the others, there was no agreement. The Brahmans introduced by *Parasu Rama,* are called *chitta-pavanar,* and were brought from *Aryanád (i e.* upper Hindustan). The *Parpara* country Brahmans are called *Mâdhinyanal.* These were instituted to their rights and privileges, by the aforementioned *Chandrangatan,* son of *Mayura Verma.*

* Or conformable to the *vedas.* As *Parasu Rama* came from the head quarters of Hinduism, he most probably brought with him, a more regular system, than that of scattered emigrants, who went before

The paper also contains a mention of kings of *Mágadha*, similar to the first section. [The conjecture arises that the *Cadamba* dynasty originated, in consequence of shaking off the yoke of *Mágadha*, of which country, probably it formed a distant province].

General Remark.—The contents of this thin octavo volume may be judged of by means of the foregoing brief abstract. The accounts of the local tribes are not without use. The last paper is important; perhaps very important. It explains the early portion of the *Kerala-Ulpatti;* gives a further view of the location of *Brahman*-colonists; and indicates a time where there were no Brahmans in the country. Under such circumstances, it is not surprising that tribes of aborigines should remain in greater numbers, than in other parts of the peninsula; from which, as we have had abundant proof, they were, to a prevailing degree, exterminated.

Manuscript book, No. 4—Countermark 888.

Section 1. Account of *Rama-raja*, and his contests with the Mahomedans.

This section contains somewhat full details of *Rama-raja's* negociations, and battles, with the neighbouring Mahomedan rulers. A pompous, and very exaggerated, statement is given of the splendour of his throne, and the number of his obsequious attendants; including the kings of all the fifty-six countries of Hindu geography. A list of his army is also given. The attacks of the Mahomedan chiefs, separately, were foiled; but a grand confederation against him of five shahs, at length overthrew him, and conquered the kingdom. The date of Sal. Sal. 1486 (A. D. 1564), is given; and it corresponds with that of the battle of *Talicota*, which ended the power of the *Vijayanagarum*, kingdom.

Note.—This document will continue legible for some years. The paper is undamaged; but the ink is not throughout equally good.

Section 2. Account of the *Banijagaru*, or traders, of *Banivassi* in the *Sunda* district.

The few details which relate to this class of *Lingadharis*, and merchants, chiefly notice the protection, or otherwise received by them from *Sada-Siva*, downwards to the times of Tippu Sultan, and the English; and the whole, in any general point of view, is unimportant. A brief mention of weights, measures, and commodities, is appended.

Section 3. Account of *Banivassi* in the *Sunda* district.

The years contained in the four *yugas*. The subject of inscriptions is adverted to, and then particularized. *Vicramàditya* is stated to have made a very large grant of land to the fane, at this place; continued in force by *Bhoja-raja*. *Sinhana Bhupalan*, who ruled at *Rudraparam*, in the neighbourhood, also made munificent largesses to the same; and built certain *gopurams*, or towers, over the porches. His son was *Cali-Cala-Sudamani*. His son was *Sangha-Bhupalan*. A detail of *Jaina-rajas* follows. In addition to the mention of a few names, there is a specification of their books, and *sastras*, or religious productions. An inflated account is given of the power, splendour, and attendants, of the said kings.

Remark.—This document seems to me of some consequence. *Banavassi* is a place of known antiquity; and the fact that *Jaina* kings of great celebrity ruled there, at an early period, is to be noted. The document is written with permanent ink; and is, as to paper, in tolerably good preservation.

Section 4. Is in the Mahratta character.

Section 5. A list of chieftains of the *Sunda* district.

The commencement of the rule of these chiefs is dated in Sal. Sac. 1478 (A. D. 1556), and seven names are given, coming down to Sal. Sac. 1685 (A. D. 1763). They were, by consequence, chiefs who founded their power on the downfall of the *Vijayanagarum* dynasty; as was the case in various parts of the peninsula. A sort of copy of their seal is given; one contains the name of *Immadi arasapa-nayak* in Balbund letters, on the other, the word, *Nagaresvara*, and *Sada-Siva*, can be read; and also the titular phrase "a chief splendid as the moon;" but some injury by worms renders the connection, in so small a surface, not further legible. An imperfect copy of an inscription certifies the gift of some lands to a tribe of Brahmans; but the donors name, and other particulars, are wanting.

The whole of the remaining portion of the book is in Mahratta characters; see the end of the following Mahratti papers. In what herein precedes, sections 1 and 3 are of consequence. The name of *Banavassi*, as an emporium of commerce, appears in the classical writers; and it then seems to have been flourishing. The prevalence of the *Jaina* credence throughout the *Sunda* country, is worthy of notice; and, by comparison with the foregoing book, we may discern that the era of *Parasu Rama* was not so high up in antiquity, as *Hindu* exaggerations might lead any one to suppose.

D.—MAHRATTI.

Manuscript book, No. 47—Countermark 737.

Ancient record concerning *Narayan-varam.*

The commencement of this document adverts to the creation by *Brahma,* and then immediately refers to *Vaivasvata menu;* to his son *Ieshvaca;* and to the ten sons of the latter, who have names given to them that appear to be fictitious. Only four brief pages are thus occupied. There is then a marvellous anachronism in referring to *Cari-Cala-Chola,* and to a story which, in other documents, is connected with *Kulottunga Cholan.* In performing penance at *Sesháchalam* he had a son by a *Naga-canya,* which son is simply termed *Chacraverti* (aliter *Tondaman* or *Adondai*). This *Chacraverti* going to *Vencatáchala* had a vision of the god; and, on the hill, found a stone image which he caused to be enshrined, and endowed. He is then termed *Go-Chacraverti,* and his son is named *Sundhama raja.* His son was *Sura sira,* and his son *Narayana raja.*

The narrative then passes at once to *Mit'hila désam,* in the extreme north. A king of this country named *Govasambuna-raja* performed penance addressed to *Vencatáchala svami* (a form of *Vishnu*) accomplished as it seems, at *Vencatáchala* or Tripety: on the god appearing to know what he wanted, he requested to be allowed to reign over the neighbourhood of the fane, transmitting the kingdom to his posterity. The request was granted by directing the worshipper to go to his servant *Naráyana,* that ruled at *Narayan puri,* who would thereupon make over to him, the applicant, half of the said *Narayan's* kingdom; which gift, on application, *Govasambuna* accordingly obtained. The name of his eldest son was *Vencata raja,* whose three brothers were respectively named *Ubajala-raja, Acasa-raja,* and *Mitra-verma-raja.* The son of the last mentioned was *Acasa-raja,* who being instituted to the kingdom, the father retreated to do penance. *Acasa-raja,* having no child, made a golden image of a goddess which he purposed to worship; but was addressed by an aerial voice, instructing him to consider that image as his child, by the name of *Pasha-trivati;* and, upon doing so, a son should be born to him. In a neighbouring wilderness called *Udyana-vanam,* the *muni* named *Nareda,* when doing penance, saw a very beautiful female form, and on asking who she was, a reply was given that she was called *Pacsha-trivani* and was the child of *Acása raja. Nareda* told her she would become the wife of *Vencatachala-svami;*

and, as he had said, the god came with great splendour, and was married to the said *Pacsha-trivati* ; on which day a child was born to *Acâsa-raja*, afterwards named *Vasumbana-raja* ; to whom he made over his rule, and retired to do penance. As *Vasumbana-raja* had no offspring he went to *Vencata-raja* of the aforementioned *Narayan-puri*, on whom he devolved the portion of the kingdom formerly conceded ; and thenceforward the kingdom became one, under kings of the *Narayan-varam* dynasty.

The son of *Vencata-raja* was *Sindu-raja*. In his time a *Kiratan*, or barbarian, made great ravages as a freebooter ; and, among other spoils, having forcibly taken away the cow of a *Brahman*, the owner went to *Sindu-raja* and complained. The *raja* assembled some forces, with which he pursued and overtook the plunderer, recovered the cow, and gave it back to the owner; afterwards continuing a prosperous rule. His son was named *Acanasana-raja*, his son was *Paracruti-raja*, and his son *Adrica-raja*. His son *Mahitha-raja*. His son *Vicata-raja*, and his son *Ribunde-raja*. During his reign enemies invaded the kingdom (their name not specified), and overthrew the *Vencata-raja* dynasty.

There follows what for distinction sake may be termed the *Rama-raja* dynasty ; containing a long list of names only, without any incident.

Remark.—So far as my abstract goes which I have made somewhat minute, and particular, there is a *vraisemblance* which, in the leading points, I consider to be assimilated to truth. We have in it in the early history of Tripety, from the time of its founder *Adondai* ; but apparently only as a feudal chieftainship, merging in a larger one : the precise locality of which I feel at present unable to fix ; but I think that *Naragana puri*, if a real name, must have been the metropolis of a chieftain only, somewhere in the immediate neighbourhood. As to what follows, the names are so numerous, and seem so much to run in cycles, with a repetition of nearly the same names, that it must I conceive either be an encomiastic genealogy of a local chief, or else pure invention ; to which observation must be added, that, allowing for the preceding lapse of time from *Adondai*, there would not be space for the following genealogy, if reckoned downwards at the rule of even two or three years, for each ruler.

On the whole this document, from which I had expected something valuable, must be estimated as of very moderate authority, and importance ; especially in the latter portion.

Legend of the *Svarna muc'hi* river.

This document is attached to the foregoing without any other note of distinction than a single blank space intervening.

It is merely a legend, ascribing the origin of the river to *Agastya*, who was instructed to form it by an aerial voice. Being formed it was called *Svarna muc'hi*, or golden faced; and it flowed through a district, wherein many anchorets, and retired devotees, dwelt. It runs near *Chandragiri;* is united with many other rivers; is considerable at *Tripety;* and joining the northern *Punar*, runs with it to the sea.

Note.—It remains only to observe, that the entire book is in moderately good preservation. The binding, and the ink, are both good. The country paper has been attacked, in the inner and outer margin, by worms; but the examination of the document has stopped their progress; and, with moderate care, the book will last a long time. The early portion alone is of any value.

Manuscript book, No. 46—Countermark 736.

Account of *Vencatésvara-svami* at Tripety.

Reference to the *pauranic* legend of a dispute beteeen *Adi-sesha*, and *Vayu;* in the course of which they passed over many mountains, and were told by *Vishnu* that their dispute should be ended at *Vencatáchala*. At this hill *Sesha* performed penance; and on *Vishnu* desiring to know what gift was wanted, *Sesha* replied with a request that *Vishnu* would reside there, which petition was accorded; and from the residence both of *Vishnu* and *sesha*, the hill is called both *Vencatáchala*, and *Sesáchala*. In *Cali-yuga* 4900, *Tondaman Chacraverti*, coming hither, determined on building a fane; being directed to do so in a vision. He in pursuance of his purpose erected one; and provided the means for celebrating annually a nine days festival. The bestowing of grants to this fane, is thenceforward the leading subject. A few descendants of *Tondaman* gave some largesses. The *Rayer* dynasty of *Vijayanagaram*, made munificent donatives; and some grants are said to have been accorded by the Mahomedans. The shrine is stated to be frequented by numerous pilgrims; and some detail is given of the sacred pools, and other local features of the hill of Tripety. There is a reference to a local incarnation of *Vishnu*, at *Sri Permatur*, near Conjeveram; and some matters connected with the incarnation of *Vishnu* as *Rama* the son of *Dasaratha*.

Remark.—The date of *Tondaman's* founding this shrine, is the point chiefly of value in this document. His offspring of two or three des-

cendants, are only mentioned by the appellative of *Tondaman*; and then *Acása-raja* is spoken of as having ruled at *Narrayana-varam*. The *Anagundì*, and the Mahomedan, rulers superseded all antecedent ones. The mention of them is however a secondary object. The contents seem derived by abstract of portions of the *st'hala mahatmya* of Tripety.

Note.—The condition of this book is much the same as that of the last mentioned one.

Manuscript book, No. 17—Countermark 883.

Official regulations of Tippu Sultan, as to trade.

These regulations are written in three languages, Persian, Canarese, and Mahratti. Any abstract of course is not here required. The book, in every respect, is in good preservation.

Manuscript book, No. 18—Countermark 884.

This book has an endorsement in Colonel Mackenzie's hand writing. "Tippoo's regulations found at Cancoupa, November 1800. C. M. K." These are in the same three languages; but very brief. The book is a thin octavo, written on Europe paper, nevertheless slightly perforated by worms; but on the whole in moderately good preservation.

Manuscript book, No. 6—Countermark 643.

Jnánasvari Certasubdácha-pariyaya, or a compendious Mahratta Dictionary of difficult words of various meanings, compiled from the *Bhagavat gita* in *Mahratti*.

This title prefixed sufficiently explains the purport, and contents, of this little folio. It remains therefore only to observe, that it is written on thick, and very superior, country-paper, the best I have ever seen, with indelible ink, and with a *calam* or reed, in bold letters of the *Bal-band* character, only a very slight variation from *Deva-nagari*. One perforation, by termites, through the cover and some of the last leaves of the book, alone prevents its being considered in perfect preservation. With common care it will last very many years.

Manuscript book, No. 65—Countermark 862.

The contents of this small quarto are four reports or journals, of *Naráyan Rao* in his journeys through the Ceded Districts, in the consecutive years 1810, 1811, and 1812.

Subject to a general remark heretofore made on this class of documents, it only remains to note that this book, though slightly injured by book-worms, is written with indelible ink, on good country paper, and as a whole, is in moderately good preservation.

Manuscript book, No. 62—Countermark 752.

General account of the Carnatic, with the models of former rules copied from ancient records.

The earlier portion of the contents of this book relates to *inams*, (grants) or *jaghires* (estates) bestowed by the Padshahs, or Mahomedan rulers, on different fanes, persons, or special places.

After about thirty loosely written pages of the said matter, a document follows unexpectedly, which is of a historical kind. It commences with *Janamejaya;* and after the mention of a few of his descendants, passes to the line of *Jarasandha*, noticing several of the more remarkable events, and persons, of the *Mágadha* kingdom. Its transit is then to *Pratápa rudra*, and it very erroneously makes "*Bhojaraja* of Ougein" to be one of his descendants. Passing to the *Vijayanagarum* dynasty it dates the foundation of that town by *Vidyaranya*, in the 9th century of *Salivahana*, which is probably too early. It has most of the usual particulars concerning the *Rayer* dynasty, down to the confederation of the Mahomedans against *Rama raju*. It then details some proceedings of Mahomedan rulers, as far as to *Alemguir*, who employed and distinguished *Sahu raja* of the Mahrattas. Concerning these, there are some rather full details; and then a transition to the Mysore kings; the usurpation of Hyder; and the final subjugation of Tippoo by the English. This part of the book is in very good preservation.

The following contents are rules and regulations concerning cultivation, taxes, and the like as fixed by *Crishna Raja Udiyar* after his restoration to the kingdom of his ancestors, being assisted by *Purnaya* his minister. These rules were deduced after an investigation into early records, antecedent to the Mahomedan usurpation.

Remark.—It may thus appear that this document is not without some interest and value; though slenderly so in any historical point

of view, as we possess all that it contains in other and perhaps better documents. The whole of the writing is with indelible ink, on good Europe paper, entirely uninjured.

Manuscript book, No. 4—Countermark 888.

Sections 1 to 3. See the preceding Canarese portion of this report.

Section 4. Account of *Sonda*, the capital of the *Sonda* country.

This account ascends up to the time of a descendant of *Acasa raja*, of the *Tondaman* line at *Chandragiri;* who, in defect of posterity, is stated to have adopted *Vencatapati nayak* of the race of *Achyuta rayer;* and there seems to be an intimation, though the passage is obscure, that the said race were descendants of a more ancient dynasty at *Sonda*. The *Tondaman*, having a son born to him, dismissed the aforesaid *Vencatapati nayak* with some money and troops to make his own way; and he succeeded in fixing himself at *Sirisi*; having previously conquered *Chennapatnam*, and a small district around it, by the way. He took *Sirisi;* afterwards, built a town and fort there; to which he gave the name of *Chennapatnam*. He further assaulted a neighbouring fort belonging to a *Vedar* chief, which he could not take; but effected its appropriation, by giving his daughter in marriage to the *Vedar* chieftain. He began to reign in the town of *Chennapatnam*, which he had built; being crowned there in Sal. Sac. 1121 (A. D. 1198). His descendants, rulers at *Chennapatnam* were,

1 Rama raja.
Rama Chandra raja.
Vakta vadiyaru.
Arasapa Vadiyaru.
5 Rama Chandra nayak.
Arasapa nayak.
Rama Chandra.
Arasapa nayak.
9 Raghu nat'ha nayak.

Subsequently the Mahomedans in the time of *Vencapatinayak*, conquered the country. The son of that chief was named *Sada siva nayak;* a favourable report of whose capacity reaching Delhi, that Court placed *Sada siva nayak*, as their manager, in charge of the country. Various alternations occurred down to the time of Hyder Ali; who assumed the country after having pillaged it. Passing through the hands of Tippu Sultan, it came into possession of the Honourable Company.

Remark.—This document seems to be of some slight local importance.

Section 5. See preceding Canarese portion of this report.

Section 6. Account of a *Jaina matam* and of an ascetic, or hierophant of the *Jainas.*

(This section is Canarese in Mahratta characters).

Formerly what is now termed *Ahobala matam* was a *Jaina-matam,* that is shrine, or monasterium of *Jainas.* Some time subsequently *Chamundi rayer,* of the race of *Pandurayen,* went to inspect the wilderness called *Bivar-gov,* and in the midst of it, clearing some ground he built a fane to *Góstésvara;* while the celestials came and performed all the usual rites. But the image of *Góstésvara,* assumed the habit of a *Jaina* image; and in different other places *Jaina* fanes were formed; several of which are specified, at the close of this brief paper, of only four pages.

Section 7. Account of *Beleti,* in the *Sonda* country, and of a race of kings.

An accountant, through defect of posterity, was going to do penance in the wilderness where he met with the fane of *Gostesvara svami;* to which he paid homage; and by doing so, obtained two sons, who on growing to manhood fought with a neighbouring *Vedar-raja,* and took his country; over which they ruled. They were named *Andavadiyar,* and *Andana-vadiyar,* and adopted the *Jaina* credence. One or two names of their posterity follow. The country was conquered by *Bhadra-nayak;* and his race succeeded, to wit, *Basavapa-nayak* (one illegible name), *Soma-sancara nayak, Vira-Bhadra nayak.* They divided the country into two petty sovereignties. These increased their dominions: and took *Sirisi,* with other forts. The boundaries of their rule are specified.

Section 8. Account of some *Jainas,* who came by sea from the *Banga-desam.*

Some tribes of *Jainas,* styled *Samuntar* (as I suppose *Samunas*) came on board ship from *Banga-desa,* under the rule of *Anga-raja,* and *Ajala-raja.* These conquered, and took possession, of some country; of which the revenues are stated; the names of towns so captured are *Cudiyalu* and *Baracur.* After some time a chief named *Bakhtyala* fought with them; and, having conquered them, they went away to *Udapu.*

Remark.—This small fragment of two pages, may turn out to be of some use. *Cudiyalu* I believe to be the same as Mangalore; and *Baracur,* a town near *Udapu,* is stated to be a country or place between Mangalore and *Gokernam.* *Bangu desa,* I have usually understood to

be Bengal. If *Jainas* came thence by sea, it must have been a circuitous voyage; which induces me to think some other country intended. *Ajala-raja* is a name of great celebrity in *Java*, of *Hindu* origin. Query, whether the going to *Udapu* may mean sailing thither?

Section 9. Account of *Mirjan* in Canara.

In early times *Jaina-bhayar-devi* built a town and fort, by the side of a small river in the *Mirjan* district: which afterwards came under the power of the *Visiapur-Padshah*. One *Mallicar* son of *Bhatt* a *Brahman* of the *Hayga* class was seen by his preceptor asleep in the sun, shaded by the hood of a serpent; on which the preceptor asked what the said *Mallicar* would give him, on coming to the possession of his kingdom: which the young man treated as a jest. But after some time having obtained some wealth, he therewith raised a band of troops; and with it assaulted the dominions of the *Visiapur* ruler; took this district, and governed it eighteen years, till his death. It then reverted to the Mahomedans; but afterwards came under the *Nagara-raja*, or king of what is I believe usually termed *Nugger** in the province of *Bidanore*.

Section 10. Account of *Jinadanta* and other kings, from a writing by *Sivaiya Jaina Gaudu* of *Horanad* in *Canara*.

Anciently about two hundred and fifty years ago (some error in the date) one *Bairasa-vadiyar* a *Jaina* from *Uttara-madhyma-desa*, went to the country of *Sámána-maha-rayer*, son of *Jinadanta*, carrying with him an *amman* or image of a goddess, called *Padmávati;* which he placed in a shrine, near the country of the son of *Jinadanta;* and, by the merit of homage and offerings to that shrine, he conquered and acquired the whole of the said country for himself. There is some loose legendary matter; for instance, mention of a king who ruled many hundreds of thousands of years, which does not appear to be of any credibility, or consequence.

Section 11. Account of *Baracur*.

This account goes up to a high antiquity referring to the establishment of seven *Saiva* emblems by *Marcandeya-rishi*, said to be narrated in the *Marcandeya-puranam*. It is stated to be the locality of the throne obtained from *India*, and the seat of power of an *Isvara* (lord) who ruled thereon two thousand years (evidently meaning *Vicramaditya*). Afterwards

* Perhaps the *Nagara* of Ptolemy.

Salivahana ruled. The name of *Balipati*, as a titular name, occurs. As this locality was one of much commerce, many ships going and coming, it was judged expedient to celebrate a human sacrifice, on that account; and, as stated in the paper, a man was taken from one of the ships, and offered in sacrifice. *Buddha-panta raja* afterwards ruled. The narrative then alludes to the penance of *Vidyaranya svámi;* in consequence of which a shower of gold fell, which he made use of in fixing *Haka* and *Bukha*, two brothers in power, at *Vidyaranya*, and crowned or anointed them. Later down, this place came under the *Visiapur* government.

Remark.—This paper is of some little value: the abstract may however suffice.

Section 12. Account of some *Jaina* kings of *Hobhalli* and *Hosapatnum* in *Canara*.

One *Manu maha raja* came from *Uttara nát'ha*, a town so called, to this place. He was a *Jaina*. His son was named *Jina danta*, who forming an improper familiarity, with an outcaste person of the *Vedar* tribe, the father considered him to have forfeited his rights, and dignity; which the son learning sought safety in flight. There however the narrative abruptly ceases; owing to some pages of the book at the end being lost.

General Remark.—The Mahratta papers in this book are quite legible, and in tolerably good preservation; with the exception only of having been badly bound. The abstracts may suffice, in pointing to general indications of early *Jaina* rule in the Canara province. There is further an interest attaching to these papers from their relating to the site of ancient commerce with India; being the trade, as I suppose, which is indicated in sect. 11, though we should not, without such a guide, have imagined that it was thought needful to cement it with the blood of human victims. The port first made by Hippalus, in crossing the Arabian gulf, that is Musiris, is conjectured by Dr. Robertson (Disqu. p. 50) to be Merjee, or the *Mirjan* of sect. 9, but I rather venture to infer that *Mushica* the name of a district, was meant by Pliny; and in India almost every district had some leading town from which it originally took its name. Further the same writer conjectures the Barace of Pliny to be Barcelore, that is the *Baracur* of sect. 8 and 11, which is probably accurate. It is needless for me to attempt more than to offer a clue to any who may think the subject worthy of further investigation.

E.—PRACRIT.

Manuscript book, No. 9—Countermark 648.

Nigamágama-Sára, or the essence of the *Nigama* and *Agamas*.

The term *Nigama* is somewhat equivalent to "Scriptures," in a particular mode of usage. The *ágamas* are twenty eight books of *Saiva* principles. In this work the substance of the *Vedas*, and of those *Saiva* works, is professed to be given. It is a moderate sized octavo; and would be worth translation. It does not admit of abstract. The character is *Balband;* rather rudely written; and the language that of the *Brahmans* of the *Mahrashitira-desam.* The paper and ink are good. The writing may be fifty years old; though probably less.

The book is entered in Des. Catal. vol. 2, p. 100, art. vii.

Manuscript book, No. 3—Countermark 652.

Parasu Rama charitra, or account of the sixth *avatar*, the conqueror of the *Cshetriyas*, and founder of the fane named after him on the western coast.

This is a thin folio, in extremely good preservation, written with indelible ink, in the *Balband* character, and in language similar to the preceding; prevailingly Sanscrit, but with *Mahratti* intermingled, and forming a local *Prácrit.* The subject is the story of *Parasu Rama*, heretofore given: it contains the solar and lunar lines of kings. I do not find the book entered in the Des. Catalogue.

Manuscript book, No. 10—Countermark 641.

Do. No. 11—Countermark 642.

These are small, but thick, folios written in the *Deva-nagari* character, on superior country paper, with indelible ink. The contents are entitled *Gita Bhashya*, or commentary on the *Bhagavat Gita*, as contained in the *Bhishma parvam* of the *Mahabháratam.* The language is a mixture of Sanscrit *slocas*, with Mahratta interpretation; and forms a

doctrinal, or theological, work of repute. The work is complete; and in very good preservation. It is by *Jnánésvara,* alias, *Jnána deva.*

It is entered in Des. Catal. vol. 2, p. 97, art. iii.

Notandum.—The first part of my sixth report, on the collation and examination of Mackenzie Manuscripts, here concludes.

Madras, *October* 1838.

Literary and Scientific Intelligence.

[Although late, owing to the tardy appearance of the volume containing the Report, which has just reached us, we think it right to put on record the following notices of Desiderata, &c. published by the British Association for the Advancement of Science.—*Editor Madras Journal.*]

Reports requested, Researches recommended, and Desiderata noticed by the Committees of Science at the Newcastle Meeting.

REPORTS ON THE STATE OF SCIENCE.

Prof. Bache, of Philadelphia, was requested to furnish a Report on the state of Meteorology in the United States, for the next meeting of the Association.

Prof. Johnston was requested to prepare a Report on the present state of Chemistry as bearing upon Geology.

Mr. J. E. Gray, F. R. S., was requested to prepare a Report on the present state of our knowledge of Molluscous Animals and their Shells.

Mr. Selby was requested to draw up a Report on the present state of knowledge of Ornithology, for an early meeting.

Mr. Bryan Donkin (Secretary), Dr. Ure, Dr. Faraday, and Mr. Cooper were requested to Report as to the state of our knowledge on the Specific Gravity of Steam generated at different Temperatures; Mr. Donkin to act as Secretary.

Mr. E. Forbes was requested to Report on the present state of the knowledge of the Geographical Distribution of Pulmoniferous Mollusca in Britain, and the circumstances which influence this distribution.

The Council were requested to apply for a Report on the present state and recent discoveries in Geology.

Specific Researches in Science involving applications to Government or public bodies.

MAGNETICAL OBSERVATIONS.

Resolved,—1. That the British Association views with high interest the system of Simultaneous Magnetic Observations which have been for some time carrying on in Germany and in various parts of Europe, and the important results towards which they have already led; and that they consider it highly desirable that similar series of observations, to be regularly continued in correspondence with and in extension of these, should be instituted in various parts of the British dominions.

2. That this Association considers the following localities as particularly important:

Canada,	Van Diemen's Land,
Ceylon,	Mauritius, or the
St. Helena,	Cape of Good Hope;

and that they are willing to supply Instruments for the purpose of observation.

3. That in these series of observations, the three elements of horizontal direction, dip, and intensity, or their theoretical equivalents, be insisted on, as also their hourly changes, and on appointed days their momentary fluctuations.

4. That this Association views it as highly important that the deficiency yet existing in our knowledge of Terrestrial Magnetism in the Southern Hemisphere should be supplied by observations of the magnetic direction and intensity, especially in the higher latitudes, between the meridians of New Holland and Cape Horn; and they desire strongly to recommend to Her Majesty's Government the appointment of a naval expedition directed expressly to that object.

5. That in the event of such expedition being undertaken, it would be desirable that the officer charged with its conduct should prosecute both branches of observations alluded to in Resolution 3, so far as circumstances will permit.

6. That it would be most desirable that the observations so performed, both in the fixed stations and in the course of the expedition, should be communicated to Prof. Lloyd.

7. That Sir John Herschel, Mr. Whewell, Mr. Peacock, and Prof. Lloyd be appointed a Committee to represent to Government these recommendations.

8. That the same gentlemen be empowered to act as a Committee,

with power to add to their number, for the purpose of drawing up plans of Scientific co-operation, &c. &c., relating to the subject, and reporting to the Association.

9. That the sum of 400*l.* be placed at the disposal of the above-named Committee, for the purposes above mentioned.*

ASTRONOMY.

Sir J. Herschel and Mr. Baily were requested to make application to Government for increase in the instrumental power of the Royal Observatory at the Cape of Good Hope, and the addition of at least one assistant to that establishment.

SCIENTIFIC RESEARCHES IN INDIA.

Resolved,—1. That the British Association regard the measurement of an arc of longitude in India comparable in extent to the meridional arc already measured in that country, as a most important contribution to other facts illustrative of the earth's true figure, and, by a necessary consequence, to the progress of astronomy.

2. That the verification and comparison of the standards of the Indian and English surveys, as compared with the proposed Parliamentary standard, is indispensable to the correct knowledge of the meridional and parallel arcs.

3. That pendulum observations at the principal elevations, or contiguous plains, and on the sea-coasts, if possible, on the same parallels of latitude, will afford results of great value to physical science.

4. That observations for the determination of the Laws of Refraction in the elevated regions of the Himalayas, and at the Observatories of Madras and Bombay, will be a most important service to science.

5. That it is highly desirable also that magnetical observations should be made in India similar to those which are carrying on in other parts of the world, and which are justly regarded with so much interest.

6. That a topographical map of India, upon a large scale, accompanied by statistical and geological information, would be highly desirable.†

* The application to Government on this subject has been successful, the command of an expedition to the Antarctic regions being entrusted to Captain J. C. Ross.

† These Resolutions have been submitted to the consideration of the Directors of the East India Company; and, in particular, the recommendation for magnetical observations been promptly acceded to.

ORDNANCE SURVEY.

Resolved,—That a Committee be appointed to inquire how far, in the future progress of the Ordnance Survey, the several metalliferous and coal-mining districts could be represented on a larger scale. The Committee to consist of Mr. Greenough, Mr. Griffith, Mr. De la Beche, and Major Portlock.

MINING RECORDS.

Resolved,—1. That it is the opinion of this Meeting, that, with a view to prevent the loss of life and of property which must inevitably ensue from the want of accurate mining records, it is a matter of national importance that a depository should be established for preserving such records of subterranean operations in collieries and other mining districts.

2. That a Committee be appointed to draw up a Memorial and to communicate with the Government in the name of the British Association, respecting the most effectual method of carrying the above resolution into effect.

3. That the Committee consist of the following gentlemen, with power to add to their number; The Marquis of Northampton, Sir Charles Lemon, Sir Philip Egerton, John Vivian, Esq., Davis G. Gilbert, Esq., J. S. Enys, Esq., W. L. Dillwyn, the President of the Geological Section of the British Association, the President for the time being of the Geological Society of London, the Professors of Geology at Oxford, Cambridge, London, and Durham, H. T. De la Beche, Esq., John Taylor, Esq., John Buddle, Esq., Thomas Sopwith, Esq.

Specific Researches in Science involving Grants of Money.

The following new Recommendations were adopted by the General Committee.

That it is desirable that the meteorological observations made at the equinoxes and solstices, agreeably to the recommendations of Sir John Herschel, Bart., should be collected together, as far as is practicable, and reduced to an uniform mode of expression, so that comparisons may be made of the same, with a view of deducing results that may lead to the improvement and elucidation of meteorology.

That Sir John Herschel be requested to superintend the same, and that the sum of 100*l*. be placed at his disposal for that purpose.

That it is desirable that the whole of the stars observed by Lacaille at the Cape of Good Hope, the observations of which are recorded in his *Cœlum Australe Stelliferum*, should be reduced.

That Sir J. Herschel, Mr. Airy, and Mr. Henderson be a Committee for carrying the same into effect.

That the sum of 200*l*. be appropriated to that purpose.

That it is desirable that a Revision of the Nomenclature of the stars should be made, with a view to ascertain whether or not a more correct distribution of them amongst the present constellations, or such other constellations as it may be considered advisable to adopt, may be formed.

That Sir John Herschel, Mr. Whewell, and Mr. Baily be a Committee for that purpose, and to report on the same at the next meeting of the Association.

That the sum of 50*l*. be appropriated to defray the expences that may be incurred in this inquiry.

That 100*l*. be placed at the disposal of Sir D. Brewster and Professor Forbes, for the purpose of procuring Hourly Meteorological Observations, to be made at two parts in Scotland, one at Fort George, on the coast, and the other at some central part, at a great elevation above the sea.

That it appears to the Committee desirable to diffuse in this country the knowledge of the Scientific Memoirs published on the Continent, and that, for this object, 100*l*. be placed at the disposal of a Committee, consisting of Dr. Robinson, Sir John Herschel, Sir D. Brewster, and Professor Wheatstone, with power to add to their number, towards procuring the translation and publication of such memoirs as they may approve.

That Mr. Pattinson and Mr. Richardson be requested to undertake experiments to ascertain whether any perceptible Galvanic influence is exerted by the Stratified Rocks of the neighbourhood of Newcastle, and that 20*l*. be placed at their disposal to meet the expenses of such experiments.

That Dr. Arnott and Dr. Yelloly be a Committee for the purpose of improving Acoustic Instruments (in reference to diseases of the ear), with 25*l*. at their disposal.

That Mr. Cargill, Mr. Wharton, Mr. Buddle, Mr. Forster, Professor Johnston, and Mr. Wilson be a Committee for inquiries into the Statistics of the Collieries of the Tyne and Wear, with 50*l*. at their disposal.

That Sir John Robison (Secretary), and Mr. J. S. Russell, and Mr. James Smith be a Committee for instituting Experiments on the Forms of Vessels, with 200*l.* at their disposal.

Researches not involving Grants of Money or application to Government.

The Meteorological Committee was requested to furnish a System of Meteorological Instructions for the next meeting of the Association.

A Committee was formed, consisting of Mr. Greenough, Mr. De la Beche, Mr. Buddle, and Mr. Griffith, to draw up a proper form and scale of the Sections to be sent to the Geological Society by the engineers and proprietors of railways.

The following gentlemen were appointed a Committee to investigate the Salmonidæ of Scotland, and directed to place themselves in communication with Mr. Shaw, who has offered to submit his experiments on that subject to their inspection: Mr. Selby, Dr. Parnell, Mr. J. S. Menteith, Professor R. Jones, Dr. Neill, Sir W. Jardine, Bart., Secretary.

The following gentlemen were appointed members of a Committee constituted for the purpose of investigating the Insects of the genera *Eriosoma* and *Aphis*, which attack the Pines of this country; Mr. Spence, F. R. S., R. K. Greville, LL. D., Sir W. Jardine, Bart., Mr. Selby, Secretary.

The Committee on Diseases of the Lungs in Animals was reappointed.

The Committee for obtaining a complete account of the Fauna of Ireland was altered so as to consist of Capt. Portlock, Mr. R. Ball, Mr. W. Thompson, Mr. Vigors, Mr. Halliday, and Dr. Coulter, who was requested to act as Secretary.—*Reports, vol.* 7.

On Halley's Comet. By Sir John F. W. Herschel, *Bart. F.R S., &c.*

" One of the most interesting series of observations of a miscellaneous kind I had to make at the Cape of Good Hope, was that of Halley's comet.—I saw the comet for the first time after its perihelion passage on the night of the 25th of January. Mr. Maclear saw it on the 24th. From this time we both observed it regularly. Its appearance was that of a round, well-defined disk, having near its centre a very small bright object exactly like a small comet, and surrounded by a faint nebula. This nebula in two or three more nights was absorbed into the disc, and disappeared entirely. Meanwhile, the disc itself dilated with ex-

traordinary rapidity ; and by examining its diameter at every favourable opportunity, and laying down the measures by a projected curve, I found the curve to be very nearly a straight line, indicating a uniform rate of increase ; and by tracing back this line to its intersection with the axis, I was led, at the time, to this very singular conclusion, viz. that on the 21st of January, at 2h. p. m., the disc must have been a point—or ought to have had no magnitude at all ! in other words, at that precise epoch some very remarkable change in the physical condition of the comet must have commenced. So far all was speculation. But in entire harmony with it is the following fact communicated to me no longer ago than last month by the venerable Olbers, whom I visited in my passage through Bremen, and who was so good as to show me a letter he had just received from M. Boguslawski, Professor of Astronomy at Breslau, in which he states that he had actually procured an observation of that comet on the night of the 21st of January. In that observation it appeared as a star of the sixth magnitude—a bright concentrated point, which showed no disc, with a magnifying power of 140 ! And that it actually *was* the comet, and no star, he satisfied himself, by turning his telescope the next night on that point where he had seen it. It was gone ! Moreover, he had taken care to secure, by actual observation, the place of the star he observed ; that place agreed to exact precision with his computation ; that star *was* the comet, in short. Now, I think this observation every way remarkable. First, it is remarkable for the fact, that M. Boguslawski was *able* to observe it at all on the 21st. This could not have been done, had he not been able to direct his telescope point blank on the spot, by calculation, since it would have been impossible in any other way to have known it from a star. And, in fact, it was this very thing which caused Mr. Maclear and myself to miss procuring earlier observations. I am sure that I must often have swept, with a night-glass, over the very spot where it stood in the mornings before sunrise ; and never was astonishment greater than mine at seeing it riding high in the sky, broadly visible to the naked eye, when pointed out to me by a notice from Mr. Maclear, who saw it with no less amazement on the 24th. The next remarkable feature is the enormously rapid rate of dilatation of the disc and the absorption into it of all trace of the surrounding nebula. Another, is the interior cometic nucleus. All these phenomena, while they contradict every other hypothesis that has ever been advanced, so far as I can see, are quite in accordance with a theory on the subject which I suggested on the occasion of some observations of Biela's comet,—a theory which sets out from

the analogy of the precipitation of mists and dews from a state of transparent vapour on the abstraction of heat. It appears to me that the nucleus and grosser parts of the comet must have been entirely evaporated during its perihelion, and reprecipitated during its recess from the sun, as it came into a colder region; and that the first moment of this precipitation was precisely that which I have pointed out as the limit of the existence of the disc, viz. on the 21st of January, at 2h. P. M., or perhaps an hour or two later."—*Ibid.*

The second volume of the Macan and Macnaghten edition of the original Arabic of the Arabian Nights has just been published. Asia occupies the attention of Europe in our day nearly quite as much as it did at the time of the Crusades—all eyes are turned eastward. The politician looks to Asia for the solution of some of the most intricate and important questions in European diplomacy. Asia, the cradle of civilization, is now beginning to receive back the arts, commerce and literature which she gave. Even the British public, which used to think about India (five times in a century) as a place of transportation for younger sons and dowerless damsels, has begun to cast its self-worshipping eyes towards Asia: and as a sign of the times there are at this moment three translations of the Arabian Nights in progress. The first by Mr. Lane, in London, the second by Mr. Torrens, in Bengal, and the third by a German scholar at Stutdgart, whose name the writer of this notice cannot recollect. Manners, minor morals and the other conventionalities of Europe and Asia, were, and are, so different, that a verbatim translation of those celebrated tales never can be made into any of the vulgar languages of Europe—for instance, the beautiful story of Zobeida and her sisters in Galland's translation, is in the original so disfigured by highly *erotic* passages, as to be wholly unfit for translation into English—these passages are often in verse, possessing all the poetic grace and elegance, and more than the prurience of La Fontaine, or Beranger, or Lord Byron. A few of the new tales (in the Macan edition) are the very best, but to enjoy them it is necessary to be an Arabic scholar. Let no one despair: De Sacy's grammar and the (Calcutta) Kamoor* Dictionary, with two hours a day hard study, for nine months, will make a well educated man of average intellect perfectly competent to enjoy the Alif Laila. J. M.

* for sale at the College at a fifth of the original price.

Note to p. 271.

The necessity of noticing some remarks by Lieut. Campbell on Dr. Benza's nomenclature of Indian minerals, reminds the Editor, who enjoyed the pleasure and advantage of an intimate personal friendship with that lamented individual, that no record has been entered in this journal, which his contributions have given an imperishable value to, of the untimely death which put an end to his labours in the cause of geological science. Dr. Benza returned to Europe labouring under some not well defined paralytic symptoms; the result of a fall from his horse on the Neilgherry Hills, which caused some obscure injury at the base of the skull. It is understood that he never recovered from the effects of this accident, and that the catastrophe of his death was caused by his sufferings therefrom, the functions of the brain becoming implicated, leading to that degree of mental alienation which induced him to perpetrate suicide.

Pasqual Maria Benza was a native of Italy, and was in the British Medical Service under the Lord High Commissioner of the Ionian Islands, Sir Fredekick Adam, whom he accompanied to his Government at Madras, having obtained a commission in the Medical Service of the East India Company. Former numbers of this journal afford the history of his movements in this country. In professional attendance on the Governor, he visited the Neilgherry Hills twice, and in the 12th number of this journal will be found a geological itinerary of his route thither on these two occasions. The 13th number contains his able and interesting *Memoir on the Geology of the Neilgherry and Koondah Mountains*, one of the most valuable contributions to Indian geology that has been given to the world. *Notes, chiefly geological, of a journey through the Northern Circars*, is the only other contribution to this journal. All these productions were transcripts from his note books, which contained more extended observations, particularly of his route from the Neilgherry Hills down the Cauvery to Permutty, where he observed the geognostic position of the rock containing corundum, a most interesting point, which was in need of elucidation, very valuable observations on which must have been found among the papers of the deceased. Dr. Benza took to Europe with him a very extensive collection of geological specimens, and it was his declared intention to publish a volume on Indian geology, when leisure and the facilities which a residence in Europe afforded, enabled him to do so. Such a work would have contained his mature views on the subject, and the opportunity of careful analysis, would have ensured exactitude

to his mineral nomenclature, which, however, we have no reason to think was not displayed in his published papers—and this leads us to the subject which has elicited the above notice.

First, with regard to the pillars of the mausoleum at Seringapatam: It is certainly singular that one so intimately acquainted with the physical characters of minerals should have pronounced the material to be a hornblende rock, for both Lieut. Campbell's analysis, and specimens now before us presented to the Society by Lieut. Newbold, taken from the mausoleum and from the quarry at Turivacary, would satisfy the merest tyro that it is a species of steatite. It is certain that Dr. Benza never could have examined the pillars minutely, but that he must have taken Buchanan's account of them as correct, to which he might further have been led by the external aspect of the pillars, which in colour resemble hornblende. Dr. Benza never visited the quarry at Turivacary. The only rock to which, in our opinion, Dr. Benza stands pledged for mineralogical accuracy is the hornblende rock, or greenstone, of Seringapatam (No. 46 of his illustrative specimens), a fragment of which, with his own label, is now before us, and is clearly what he has designated it. In the ingredients assigned to the other rock by Lieutenant Campbell, and in its infusibility, it exactly answers to the chemical characteristics of steatite or potstone. In a descriptive account of minerals presented to the Society by Lieut. Newbold, written more than a year ago, that officer has pointed out the error into which Buchanan had fallen, whom Benza followed, and he therein assigns its true denomination to this rock.

Secondly, respecting the *eurite* of Palicondah, Dr. Benza appears, from Lieut. Campbell's own showing, to be in no error—Eurite (an old term of Werner's, we believe) is nothing but compact felspar; which is fusible, containing silica, alumina, an alkali, and iron—precisely the components of the rock of Palicondah, according to Lieut. Campbell. We can further state that Dr. Benza's own specimens of eurite in our possession, exhibit all the external characters of that rock.

Thirdly, as to the silicious schist—that rock being a slate composed principally of silex; and hornstone being of similar chemical composition, but wanting the slaty fracture; if the schistose character is observable in the mass (it clearly is in Dr. Benza's specimens), the term he applies is likely to be the correct one.—*Editor.*

VII.—*Horary Meteorological Observations made agreeably with the suggestions of Sir* John Herschel.

1st.—*At the Madras Observatory.—By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

Date.	Time.	Barometer.	Thermometer	Wet bulb.	Direction of wind.	Strength of wind.	Remarks.
Sept. 21	6 A. M.	29,903	76,9	72,6	W	1	Thick haze.
	7	29,936	77,1	73,0	W	1,2	Do.
	8	29,968	78,6	73,0	W	1,2	Do.
	9	29,978	80,5	73,0	W	2	Do.
	10	29,974	82,0	72,3	W N W	2	Do.
	11	29,960	82,9	72,5	W	2	Haze.
	12	29.934	85,2	73,5	N W	1,2	Haze.
	1 P. M.	29,917	86,8	74,5	W N W	2,3	Thick haze, strong wind.
	2	29,884	88,0	75,3	W N W	2,3	Do. do.
	3	29,861	88,0	74 0	N W	2,3	Do. do.
	4	29,854	88,0	73,2	N W	2,3	Do. do.
	5	29,874	87,0	73,8	N W	1	Haze. gentle wind.
	6	29,892	84,8	74,6	N W	1	Clear. do.
	7	29,900	82,8	75,5	N W	1	Do. do.
	8	29,912	79,6	75,1	N W	1	Do. do.
	9	29,936	78,1	75,1	S W	1	Do. do.
	10	29,930	79,3	75,1	S	1	Cloudy. do.
	11	29,936	80,4	74,5	S W	1	Flying clouds do.
	12	29,916	80,0	74,1	W	1	Clear. do.
	1 A. M.	29,906	78,4	74,5	S W	1,2	Do. moderate wind.
	2	29,902	78,0	74,5	S W	1,2	Do. do.
	3	29,902	77,8	74,3	S W	1,2	Do. do.
	4	29,900	77,4	74,0	S W	1,2	Do. do.
	5	29,906	76,8	73,9	W	1,2	Do. do.
22	6	29,942	77,3	71,9	W	1,2	Haze. do.
	7	29,952	76,5	71,5	S W	1,2	Do. do.
	8	29,964	78,9	72,4	S W	2	Do. strong wind.
	9	29,974	80,8	73,1	W	2	Do. do.
	10	29,971	83,0	73,5	W	2	Do. do.
	11	29,962	84,8	74,0	W	2	Thick haze—moderate wind.
	12	29,926	86,3	75,9	W	1,2	Do. do.
	1 P. M.	29,900	88,0	77,1	N N W	2	Do. gentle wind.
	2	29,876	88,3	76,6	N W	2	Do. strong wind.
	3	29,864	88,5	76,5	N W	1	Do. gentle wind.
	4	29,864	88,4	76,4	N W	1	Haze. do.
	5	29,872	88,0	76,0	N W	1	Do. do.
	6	29,890	85,4	78,2	S E	1	Cloudy. do.

2*d.—At the Trevandrum Observatory.—By the Rev.* G. SPERSCHNEIDER, *Superintendent.*

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks
Dec. 21	6 A.M.	29.703	73.0	2.6	69.12		,,		Sky very clear calm
	7	.730	74.0	2.9	69.70		,,	2.5	Do. cum. about the horizon do.
	8	.762	77.4	3.5	68.19		,,	0.5	Do. do. do.
	9	.768	80.5	5.2	73.14		,,	3.0	Do. do. do.
	10	.766	82.5	7.4	71.95		,,	cly.	Fly. clo. do.
	11	.757	84.0	8.4	72.07		,,	9.0	Zenith clear—light clouds about the horizon do.
	Noon.	.731	86.0	9.9	71.97	S	2	4.5	Do. do. light air
	1 P.M.	.692	87.6	10.8	72.38	S E	4	12.7	Do. cum. about the horizon—gentle wind
	2	.669	86.6	11.0	70.87	S	3	11.5	Do. do. do.
	3	.656	85.6	9.7	71.82	do	,,	cly.	Cloudy calm
	4	.653	84.8	9.1	~1.81	do	,,	do	Very clo. at 4h 7m—drizzling—do.
	5	.660	84.5	8.7	72.16	do	,,	do	Clearing do.
	6	.674	83.0	8.0	71.57	do	,,		Zenith clear, rest becoming clo. do.
	7	.711	82.0	6.5	72.80	do	,,		Very cloudy do.
	8	.730	81.5	5.9	73.17	do	,,		Do. do.
	9	.749	80.0	4.9	73.06	do	,,		Do. do.
	10	.769	78.0	3.6	72.88	do	,,		Sky getting clear do.
	11	.755	76.2	2.7	72.33	W	1		Sky rather cle. wind just percept.
	Mid.	.739	75.5	2.8	71.48	do	,,	No. observation.	Do. calm
,, 22	1 A.M.	.713	74.7	2.1	71.66	do	,,		Quite clear do.
	2	.704	74.2	2.1	71.14	do	,,		Do. do.
	3	.678	74.0	1.9	71.23	do	,,		Do. do.
	4	.663	73.5	1.4	71.46	do	,,		Do. do.
	5	.665	73.0	1.4	70.95	do	,,		Do. do.
	6	.673	74.0	3.4	68.92	do	,,		Do. haze about the horizon do.
	7	.697	73.5	2.4	69.95	do	,,	0.5	Do. do. do.
	8	.727	77.5	2.9	73.39	do	,,	1.0	Zenith cle. cum. about the hor. do.
	9	.742	80.5	4.9	73,60	do	,,	4.5	Do. do. do.
	10	.740	83.8	8.1	72.32	do	,,	5.5	Do. do. do.
	11	.719	85.2	9.8	71.20	do	,,	1.8	Sky getting cloudy do.
	Noon.	.700	87.3	10.0	73.30	S E	6	8.5	Lt. fly. clo. in the zenith. do. plt. w.
	1 P.M.	.675	87.8	11.0	72.29	do	6	14.0	Do. do. do.
	2	.646	87.2	11.2	71.25	do	6	5.0	Do. do. do.
	3	.642	87.4	11.1	71.66	do	6	cly.	Threatg.—thun. at 3h 30m—rain—do
	4	.639	83.6	8.5	71.45	N	3	rg.	Rain continued gentle breeze
	5	.667	79.3	4.7	72.61	do	1	cly.	Overcast—wind just perceptible
	6	.687	78.0	3.5	73.03	do	,,		Do. do.

December 21st fell rain from 6 A. M. to 6 P. M. None.
do. 6 P. M. to 6 A. M. do.
December 22d do. 6 A. M. to 6 P. M. ·1304
Total .1304

The Instruments are the same, and situated exactly as before.

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF JULY, 1839

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o									
July 1	29,858	29,762	29,854	83,7	85,0	80,7	3,3	5,3	6,0	0,095	......	......	S W	S E	W BY S W	Cloudy	Cloudy	Cloudy—lightning and thunder.
2	,854	,782	,848	82,8	86,0	81,2	4,8	6,5	5,8	......	......	......	W	W BY S W	S. SW	Cloudy	Cloudy	Do. do.
3	,852	,750	,818	86.7	87,4	83,9	8,2	8,4	3,4	......	......	3,203	S W	W BY N W	S	Cloudy	Cloudy	Flying clouds do.
4	,832	,736	,832	83,6	87,0	84,6	4,1	6,0	4,9	0,179	......	......	S E	S. SE	S	Cloudy	Cloudy	Do. do.
5	,850	,744	,824	86,0	88,5	84,8	9,5	7,1	5,2	......	......	......	S W	S. SE	S. SW	Fl. cl.	Cloudy	Do. vivid do.
6	,842	,718	,802	86,7	91,8	85,2	8,5	10,4	4,1	......	......	......	S W	S. SE	S	Clear	Fl. cl.	Cloudy—loud thunder & vivid lightning with rain.
7	,828	——	,828	86,6	—	87,3	6,1	—	9,7	1,206	......	......	S W	——	S. SE	Clear	——	Do. lightning.
8	,874	,780	,832	84,0	85,4	83,8	5,2	5,5	8,2	......	......	......	S W	W BY S W	W	Cloudy	Cloudy	Cloudy do.
9	,800	,700	,770	84,1	89.4	85,9	7,7	12,9	7,9	......	......	......	S W	W	W	Cloudy	Cloudy	Fl cl. do.
10	,810	,708	,772	86,3	93,6	89,3	10,7	7,7	10,8	......	......	2,999	S W	W N W	W	Clear	Cloudy	Do. do.
11	,834	,722	,804	88,7	91,9	85,3	10,4	14,4	8,7	......	......	......	S W	S W	S W	Th. hz.	Cloudy	Cloudy—thunder and lightning.
12	,844	,736	,848	85,8	90,6	88,3	9,9	13,6	10,8	0,287	......	......	S W	W N W	W	Cloudy	Cloudy	Fl. cl. lightning.
13	,842	,738	,818	87,7	95,8	88,9	10,3	17,8	9,1	......	......	......	W	W N W	S	Clear	Cloudy	Flying clouds.
14	,844	——	,830	88,0	—	87,8	12,0	—	6,5	......	0,117	......	W	——	S	Haze	——	Cloudy—lightning.
15	,868	,792	,894	87.1	88,6	86,3	10,6	5,7	6,8	0,067	......	......	W	S. SE	S E	Haze	Haze	Fl. cl. do.
16	,918	,802	,940	86,1	81,5	85,7	7,6	3,5	5,2	0,430	......	......	W	S	S	Haze	Cloudy	Haze do.
17	,988	,880	,962	85,9	88,0	85,9	7,9	7,8	5,0	......	......	3,833	W	S. SE	S	Cloudy	Fl. cl.	Fl. cl.—lightning and thunder.
18	,956	,856	,922	83,2	88,2	84,5	6,2	9,2	4,0	0.628	......	......	S W	S. SE	N W	Cloudy	Cloudy	Cloudy—thunder and lightning.
19	,942	,846	,892	84,2	87,0	81,3	6,9	8,2	3,6	......	......	......	W	W	N	Cloudy	Cloudy	Squally—do. and vivid lightning.
20	,914	,808	,894	85,2	91,0	84,1	7,4	12,1	5,7	......	......	......	W	W	S	Fl. cl.	Fl. cl.	Do. do. do. do.
21	,900	——	,902	84,7	—	84,2	7,2	—	5,7	0,177	......	......	W	——	S W	Clear	——	Do lightning.
22	,902	,782	,896	84,3	89,4	82,3	6,8	9,4	4,5	......	0,592	......	S W	S. SE	N W	Cloudy	Cloudy	Do. do. and thunder
23	,880	,744	,844	84,2	86,9	83,3	7,4	6,9	3,7	0,024	0,400	......	S W	N	W	Cloudy	Cloudy	Cloudy and lightning.
24	,844	,706	,798	84,2	89,0	85,3	6,7	12,5	5,7	......	0,020	2,352	S W	S W BY W	W	Cloudy	Cloudy	Thick haze. do.
25	,810	,706	,792	84,0	89,5	84,5	4,5	10,0	6,0	......	0,317	......	W	W	S W	Cloudy	Cloudy	Fl. cl. do.
26	,800	,708	,800	84,6	90,8	85,0	7,0	11,3	6,0	......		......	W	W	S W	Cloudy	Cloudy	Cloudy do.
27	,854	,724	,858	85,9	88,3	86,3	1,8	5,8	6,2	......		......	S W	S. SE	S	Haze	Fl. cl.	Do.
28	,894	——	,886	86,3	—	86,2	4,8	—	7.1	......		......	W	——	S W	Clear	——	Do.
29	,888	,786	,856	87,2	89,9	85,3	7,2	6,9	9,5	......		......	W	S SE	S W	Haze	Fl. cl.	Fl. cl. lightning.
30	,860	,770	,826	86,8	89,0	85,9	6,8	7,1	4,7	0,037		......	W	S. SE	S	Haze	Fl. cl.	Do. do. and thunder.
31	,818	,756	,826	87,8	89,0	85,7	8,2	7,3	4,0	0,038		3,480	N W		S. SW	Haze	Clear	Clear. do.
Mean	29,865	29,761	29,847	85,6	88,9	85,2	7,3	8,9	6,3									

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF AUGUST, 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o									
Aug. 1	29,860	29,770	29,892	87,0	89,0	86,3	8,3	5,5	4,9	......	......	......	N W	S. SE	W	Clear	Clear	Cloudy—lightning.
2	,868	,800	,868	87,8	89,0	86,1	9,4	8,5	5,1	......	......	......	S W	SE. E	S	Clear	Fl. cl.	Fl. cl. do
3	,858	,770	,860	88,3	89,3	85,7	10,5	7,0	6,2	......	......	......	N W	ES. S	W	Haze	Cloudy	Driz. rain thunder & vivid lightning.
4	,840	—	,850	85,7	—	85,2	6,0	—	6,6	1,204	......	......	W	—	S. SW	Cloudy	—	Do. do. lightning.
5	,844	,752	,842	85,0	82,0	86,3	7,6	13,0	6,8	......	......	......	W	W	S W	Cloudy	Cloudy	Do. do. do.
6	,872	,766	,840	86,3	81,0	85,6	6,6	10,5	4,6	......	......	......	W	E	S	Haze	Fl. cl.	Clear.
7	,872	,782	,844	88,3	89,0	85,2	11,6	9,0	10,3	......	......	3,158	N W	E	S W	Clear	Fl. cl.	Do. lightning.
8	—	,766	,836	—	89,5	87,5	—	9,0	5,9	......	......	......	—	S. SE	S	—	Cloudy	Flying cl.—thunder and lightning.
9	,874	,772	,841	83,8	86,0	86,0	4,3	7,0	4,9	0,076	......	......	N E	NW. W	S	Dr. ra.	Cloudy	Do. do. do.
10	,862	,794	,874	81,8	84,4	83,4	6,1	5,4	3,3	1,651	......	......	W	S. SW	S W	Cloudy	Cloudy	Do lightning.
11	,906	—	,886	83,0	—	84,1	6,0	—	4,0	......	......	......	SW. W	—	S W	Cloudy	—	Do. do.
12	,904	,822	,914	84,0	89,0	85,3	7,5	8,1	5,6	......	......	......	N W	SE. E	W. SW	Cloudy	Cloudy	Do. do.
13	,912	,790	,882	84,5	87,4	81,6	6,7	7,0	3,6	0,101	......	......	W	SE. E	S	Clear	Fl. cl.	Do. do.
14	,894	,818	,910	82,3	86,0	84,9	4,8	5,5	3,9	0,042	......	2,350	N W	S E	S W	Cloudy	Cloudy	Cloudy do.
15	,880	,794	,880	84,5	85,6	82,3	6,1	4,7	3,2	......	......	......	W	S W	W	Cloudy	Cloudy	Drizzling rain, lightning and thunder.
16	,912	,820	,882	79,8	81,5	78,4	0,3	4,5	1,4	0,127	1,064	......	N W	W	S W	Cloudy	Clear	Rain—clear do.
17	,876	,780	,825	82,1	82,5	81,8	5,1	3,5	2,4	......	......	......	N W	E	S W	Cloudy	Cloudy	Flying clds— thunder and lightning.
18	,818	—	,818	82,2	—	81,7	3,8	—	2,6	......	0,467	......	N W	—	S W	Cloudy	—	Cloudy do. do.
19	,790	,722	,792	78,6	81,2	80,0	2,1	2,4	2,0	0,044	0,046	......	N W	W	S W	Cloudy	Cloudy	Do. do. do.
20	,794	,728	,838	78,5	81,8	78,0	1,9	2,8	0,0	0,809	......	......	S W	S	S W	Cloudy	Cloudy	Do. —
21	,882	,808	,894	79,4	82,6	81,0	1,9	6,4	1,5	0,707	......	0,963	S W	W	S	Cloudy	Cloudy	Do. lightning
22	,906	,810	,884	80,9	85,6	85,5	3,4	6,6	5,1	......	......	......	S W	S W	S E	Clear	Cloudy	Do. do.
23	,906	,804	,880	82,1	84,3	82,5	4,4	6,0	2,1	......	......	......	W	W	S	Cloudy	Cloudy	Do. do.
24	,906	—	,906	81,9	—	82,8	2,2	—	2.4	......	......	......	W	—	S	Cloudy	—	Do. do.
25	,922	—	,950	83,0	—	81,9	3,0	—	1,6	......	......	......	N W	—	S W	Th. hz.	—	Do. do.
26	,946	,808	,880	82,0	86,5	83,9	5,0	8,8	5,9	......	0.027	......	S W	S W	N W	Cloudy	Fl. cl.	Fl. cl. do.
27	,872	,754	,820	82,9	86,4	84,0	6,9	9,4	3,2	......	0,027	......	S W	N E	S W	Cloudy	Cloudy	Cloudy—lightning.
28	,836	,724	,844	82,0	86,5	83,5	3,9	7,5	3,5	......	......	1,918	S W	W	W	Cloudy	Cloudy	Drizzling rain—lightning.
29	,836	,740	,844	83,8	87,0	84,6	5,0	7,5	3,8	0,097	......	......	W	W	S W	Cloudy	Cloudy	Rain, thunder and lightning.
30	,840	,758	,842	83.4	86,8	84,4	4,4	7,8	4,4	0,337	......	......	N W	N W	S	Th. hz.	Cloudy	Haze—lightning.
31	,896	,810	,904	84,0	88,0	86,1	4,7	8,0	4,1	......	......	......	W	E	S	Clear	Fl. cl.	Do. do.
Mean	29,873	29,779	29,865	83,3	85,7	83,8	5,3	7,0	4,0									

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF SEPTEMBER, 1839.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.
1839	Inch.	Inch.	Inch.	o	o	o	o	o	o									
Sep. 1	29,930	29,836	29,910	85,0	81,5	86,3	5,5	6,1	3,0	......	......	......	N W	E	S W	Clear	Fl. cl.	Flying clouds—lightning
2	,904	——	,914	86,3	—	85,7	9,7	—	4,2	......	......	......	N W	——	S E	Clear	——	Clear do.
3	,922	——	,930	86,3	—	86,4	5,3	—	3,7	......	......	......	S	——	S	Clear	——	Cloudy do. and thunder
4	,932	29,838	,910	86,0	88,7	84,4	6,3	6,9	3,5	......	......	3,082	S W	S E	S	Haze	Cloudy	Clear do. and thunder
5	,890	,775	,882	97,6	89,0	87,3	6,8	6,2	4,7	......	......	......	W	S E	S	Haze	Fl. cl.	Cloudy—thunder and lightning
6	,866	,752	,892	84,0	86,8	88,0	8,4	3,8	2,8	0,851	......	......	S W	S E	S	Clear	Clear	Fly. clouds—lightning
7	,896	,766	,880	84,5	87,4	84,5	4,5	4,5	3,5	......	......	......	W	E	S E	Clear	Clear	Fly. cl.—loud th. & viv. lig. at night
8	,896	——	,884	85,6	—	83,5	5,2	—	2,1	0,037	......	......	S W	——	N	Fl. cl.	——	Clo. thunder at day time, lt. at night
9	,860	,755	——	82,5	80,0	—	3,0	2,0	—	......	......	......	S W	W	——	Cloudy	Cloudy	—— thunder and lt. at day and night
10	,800	——	,804	86,9	—	79,9	10,9	—	2,9	3,932	......	......	W. N W	——	W	Cloudy	——	Cloudy—lightning at night
11	,853	,758	,850	81,3	83,0	82,0	3,3	2,6	2,5	0,070	0,057	2,265	S W	E	S	Fl. cl.	Cloudy	Fly. clouds—thunder and lightning
12	,884	,784	,862	80,8	84,2	81,9	3,4	3,3	1,9	......	......	......	W	S E	S	Cloudy	Fl. cl.	Cloudy—thunder and lightning
13	,910	,800	,902	82,1	84,0	82,4	6,0	3,1	2,6	0,158	......	......	W	S E	S E	Fl. cl.	Fl. cl.	Clear do. do.
14	,962	,846	,940	88,2	82,8	81,8	1,9	2,3	2,9	......	0,187	......	W.	S	S	Cloudy	Cloudy	Clo. loud thunder & vivid lightning
15	,970	——	,944	79,9	—	80,8	1,7	—	1,0	4,809	......	......	W	——	S	Cloudy	——	Flying clouds—lightning
16	,956	,832	,978	78,7	82,8	81,2	1,2	2,8	1,2	......	0,157	......	SW	W	S	Cloudy	Cloudy	Flying clouds do.
17	,892	,804	,898	80,3	81,0	80,3	1,3	2,5	1,4	......	......	......	W	W	S W	Cloudy	Cloudy	Cloudy do.
18	,894	,800	,874	80,3	81,4	80,5	5,1	3,9	3,3	......	......	1,459	W	W	S W	Cloudy	Cloudy	Do. do.
19	,942	,844	,944	80,8	81,0	80,3	1,9	3,0	2,8	......	0,020	......	W	W	W	Cloudy	Cloudy	Do. do.
20	,970	,846	,922	81,3	84,6	82,3	4,3	6,1	4,3	......	......	......	W	W	S W	Cloudy	Cloudy	Thick haze do.
21	,974	,854	,930	82,0	88,0	79,3	9,7	14,8	4,2	......	......	......	W. N W	N W	S	Th. haze	Th. hz.	Cloudy ——
22	,971	,864	,952	83,0	88,4	84,4	9,5	12,0	4,4	......	......	......	W	N W	S	Clear	Haze	Do. lightning
23	,972	,864	,938	84,0	89,9	84,2	8,0	10,9	3,7	......	......	......	W	N W	S	Haze	Fl. cl.	Clear —— dew
24	,976	,876	,954	86,0	87,5	82,1	9,0	8,5	3,6	......	......	......	N W	E	S	Clear	Cloudy	Do. lightning do.
25	,970	,878	,968	84,7	87,4	84,9	5,9	9,9	5,4	......	......	2,488	S W	E	S E	Clear	Fl. cl.	Cloud do. do.
26	,990	,874	,962	83,6	88,5	85,8	6,6	10,6	5,4	......	......	......	W	N E	S E	Cloudy	Fl. cl.	Do. do. do.
27	,986	,868	,938	85,8	85,0	82,0	6,2	3,5	2,8	......	0,864	......	S W	S E	S E	Fl. cl.	Fl. cl.	Flying clouds do. do.
28	,976	,866	,966	84,6	87,0	84,8	5,7	7,0	5,4	......	......	......	S W	S E	S W	Clear	Cloudy	Flying clouds do. do.
29	,960	——	,950	85,0	—	86,1	5,9	—	3,6	......	......	......	S W	——	S	Clear	——	Flying clouds do. do.
30	,956	,840	,936	85,8	88,5	86,3	9,2	5,5	3,3	......	......	......	S W	S E	S	Clear	Cloudy	Flying clouds do. do.
Mean	29,929	29,826	29,915	83,8	85,4	83,4	5,7	5,9	3,3									

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about 5 feet above the surface of the ground, and 27 feet above the level of the Sea; the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which I have lately constructed, and may be depended upon to 0,0100 an inch.

T. G. Taylor,
H. C. Astronomer.

ERRATA.

Page	*line*		
287	2d	from bottom	For sulphureous, read sulphurous.
289	7th	do..........	Erase the word "*Chloric.*"
308	14th	do..........	Erase "it is," and read,—The lunar caustic of the apothecary, which is soluble in water, is a proper test for muriatic acid.
323	14th	do..........	For substance, read substances.